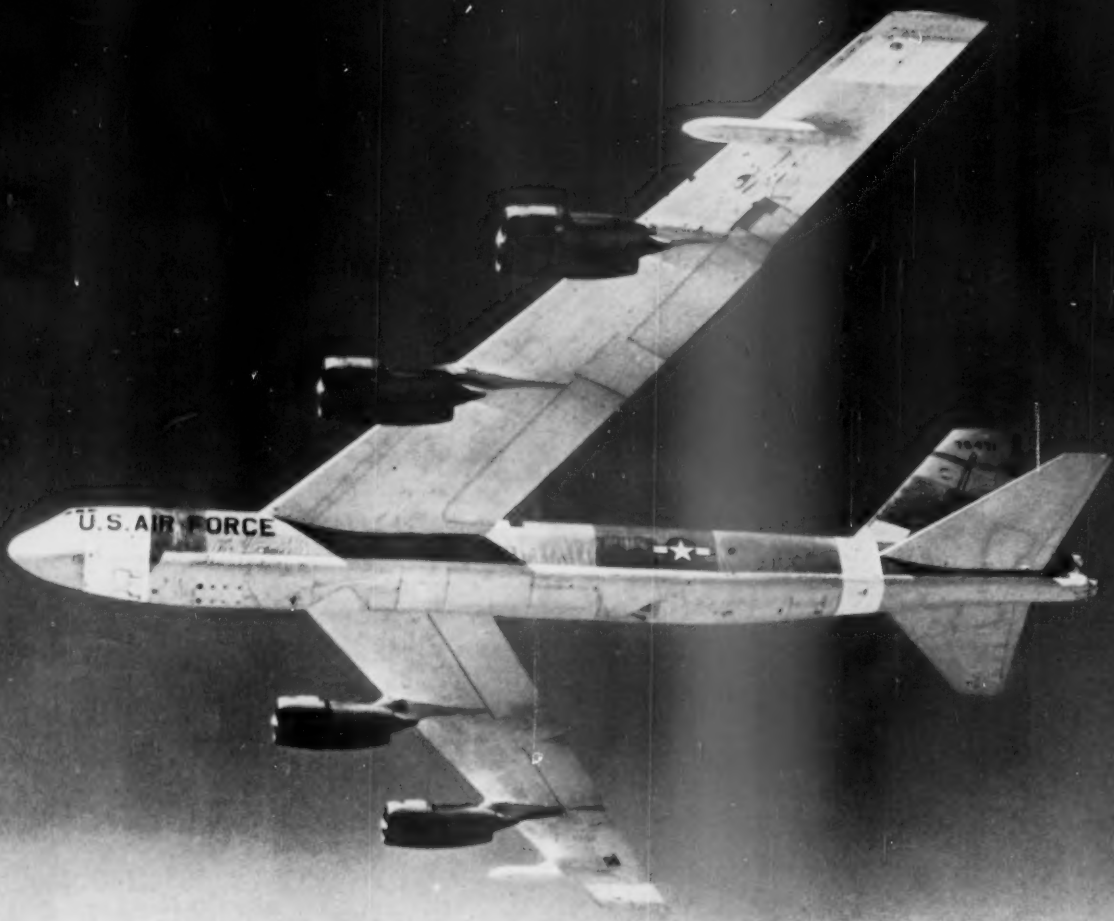
August 1, 1960

Aviation Week and Space Technology

A McGraw-Hill Publication

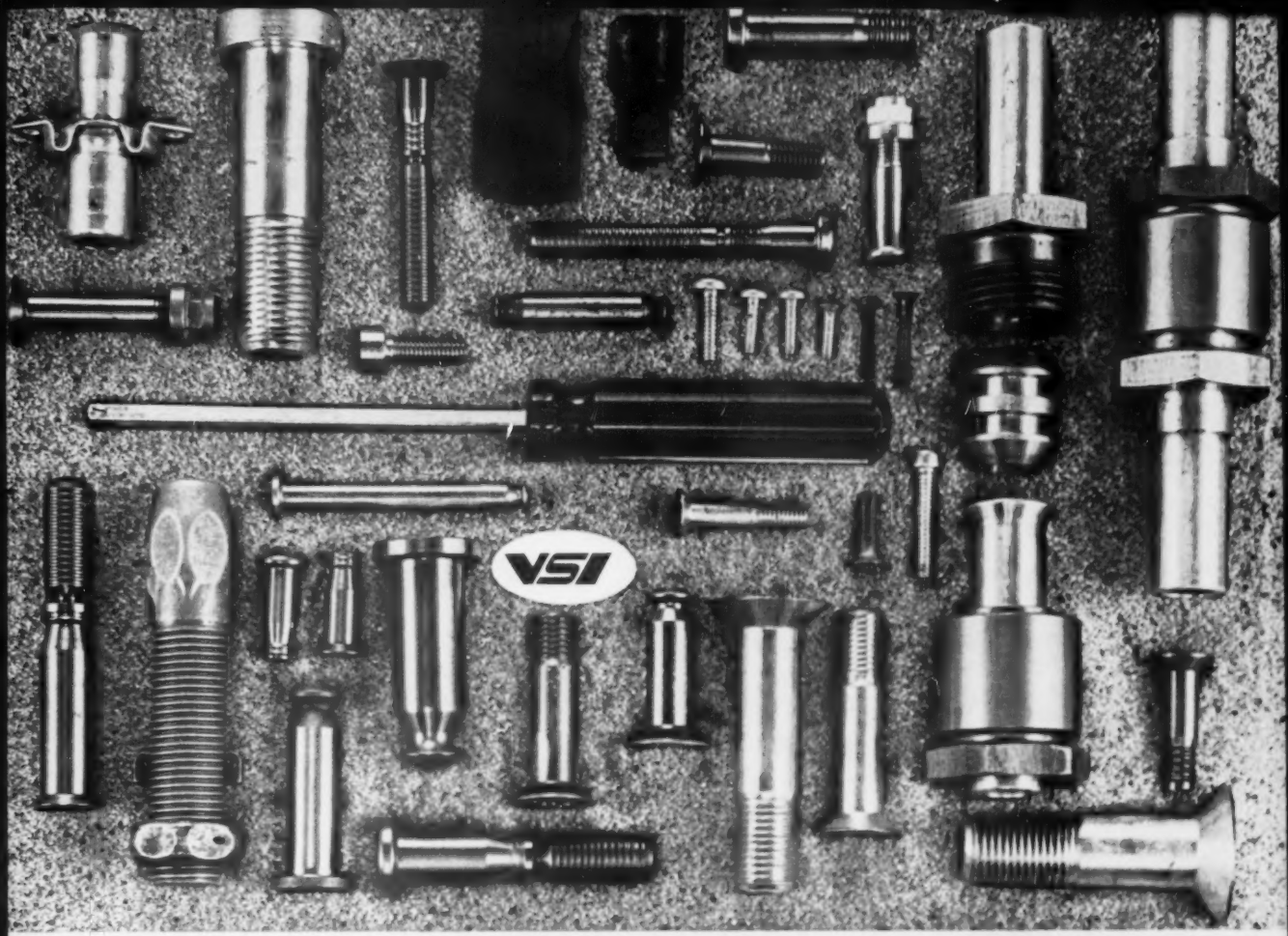
Marquardt Plans Avionics, Space Diversification



Boeing B-52G Tests Turbofans

SPECIAL REPORT:

Manned Space Vehicle Designs Studied



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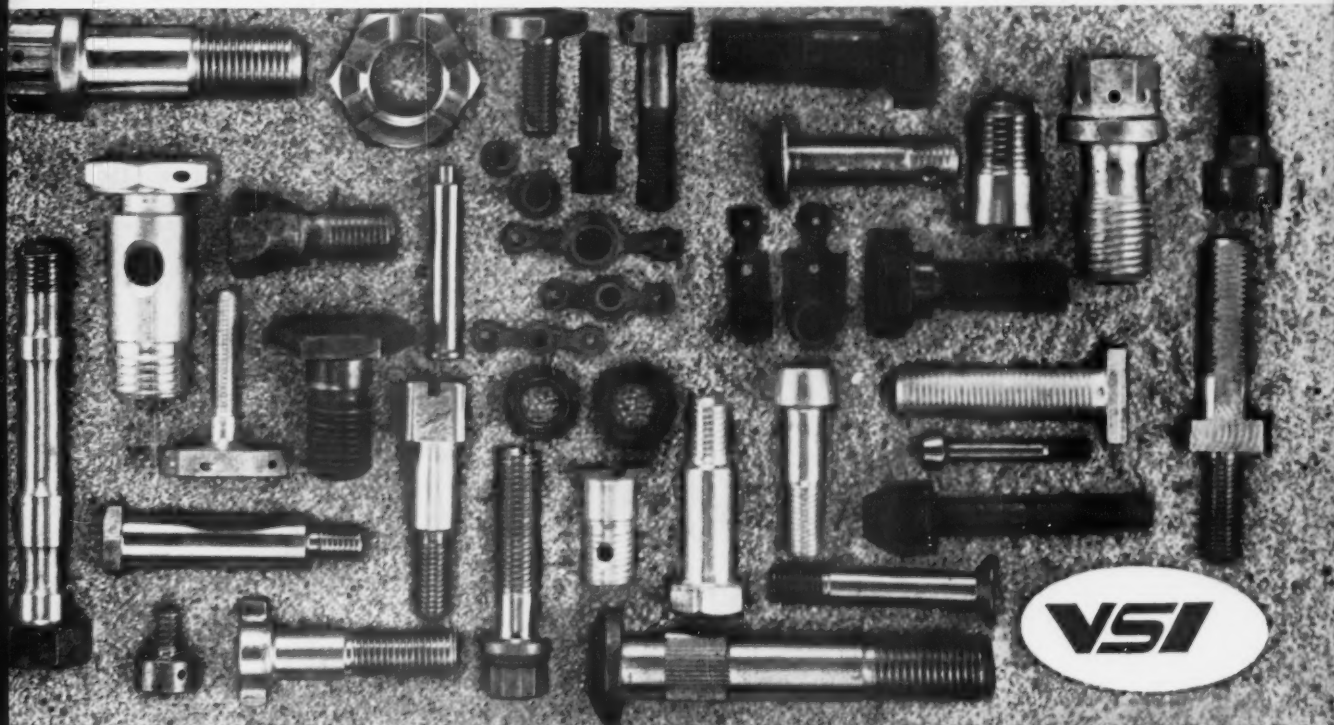

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X-ray photo reveals Goodyear's strict quality control in manufacturing Iceguard. Unbroken heating wires are perfectly spaced for efficient action. Iceguard comes in two types: electrically conductive rubber and with knitted wire elements embedded in rubber.
lots of good things come from
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Iceguard—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

a message to men who keep a thought ahead of progress . . . Butler and Edwards lacked all but vision when they designed their 19th century delta-winged jet. ■ But with today's methods and materials, vision itself is often the only requisite to progress. ■ If your concepts border on reality, perhaps Ex-Cell-O's experience can help turn your prints into skyborne products through our precision-machined parts and assemblies, fuel control devices, servomechanisms, actuators, inertial guidance systems, remarkably precise, numerically-controlled machine tools, and other manufacturing capabilities available to you today. ■ Call our Representative, or contact Ex-Cell-O's Aircraft & Missile Division, Detroit.

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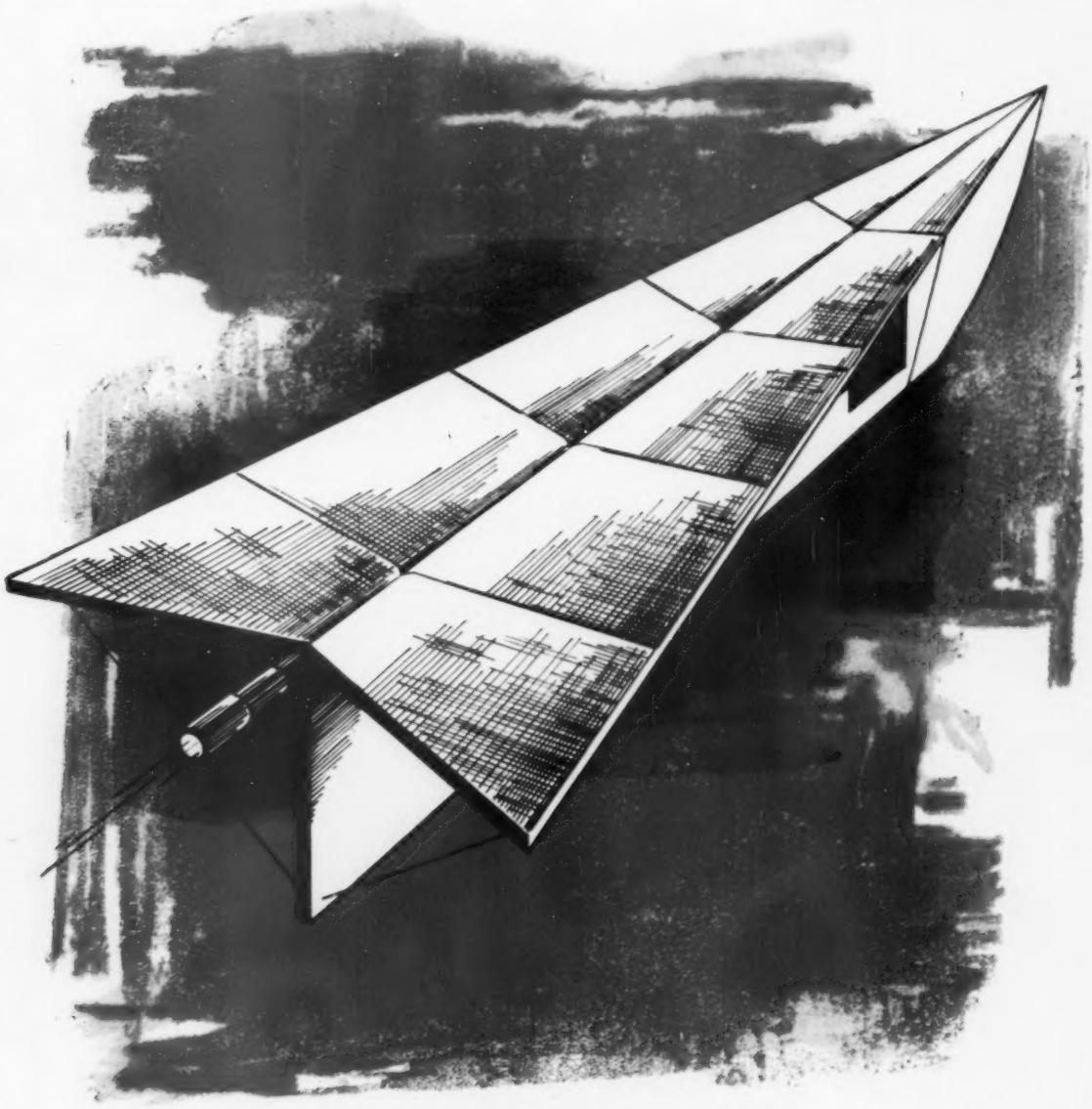
Aircraft & Missile Division

The use of a solid fuel propellant, and a sliding nacelle amidships for longitudinal control, were among the advanced features of this jet aircraft design proposed by Englishmen Butler and Edwards in 1867.



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MAN AND MISSILES FLY HIGHER, FASTER AND SAFER WITH PARTS AND ASSEMBLIES BY EX-CELL-O AND ITS SUBSIDIARIES: BRYANT CHUCKING GRINDER CO., CADILLAC GAGE CO., MICHIGAN TOOL CO., SMITH BEARING CO. ■ EX-CELL-O FOR PRECISION XLO

AVIATION CALENDAR

Aug. 7-15—Third Annual Institute on Missile and Rocket Technology, University of Connecticut, Storrs, Conn. Cosponsor: U. S. Army chief of R&D.

Aug. 8-11—Western National Meeting, American Astronautical Society, Olympic Hotel, Seattle, Wash.

Aug. 8-12—1960 Pacific General Meeting, American Institute of Electrical Engineers, El Cortez Hotel, San Diego, Calif.

Aug. 14-17—Fourth National Heat Transfer Conference and Exhibit, Statler Hilton Hotel, Buffalo, N. Y. Sponsors: American Institute of Chemical Engineers; American Society of Mechanical Engineers.

Aug. 15-20—11th Annual Congress, International Astronautical Federation, Royal Institute of Technology, Stockholm.

Aug. 16-18—Fourth Annual Tri-Service Conference on Biological Effects of Microwave Radiation, New York University Post-Graduate Medical School, NYU Medical Center, N.Y.C. Sponsor: Air Research and Development Command.

Aug. 18-19—Second International Symposium on Submarine and Space Medicine, Laboratory of Aviation and Naval Medicine, Karolinska Institute, Stockholm.

Aug. 18-19—Electronic Packaging Symposium, University of Colorado, Boulder.

Aug. 23-25—1960 Cryogenic Engineering Conference, University of Colorado.

Aug. 23-26—Western Electronic Show & Convention, Los Angeles Memorial Sports Arena, Los Angeles, Calif.

Aug. 28-Sept. 5—1960 National Air Rally, Municipal Airport, Orange, Mass. Sponsor: National Aeronautic Assn.

Sept. 1—Symposium on Rocket and Satellite Instrumentation, Society of Instrument Technology and British Interplanetary Society, London, England.

Sept. 4-5—Civilian, Closed-Course Airplane Races, Lakefront Airport, Cleveland.

Sept. 5-11—1960 Farnborough Flying Dis-

(Continued on page 6)

AVIATION WEEK and Space Technology

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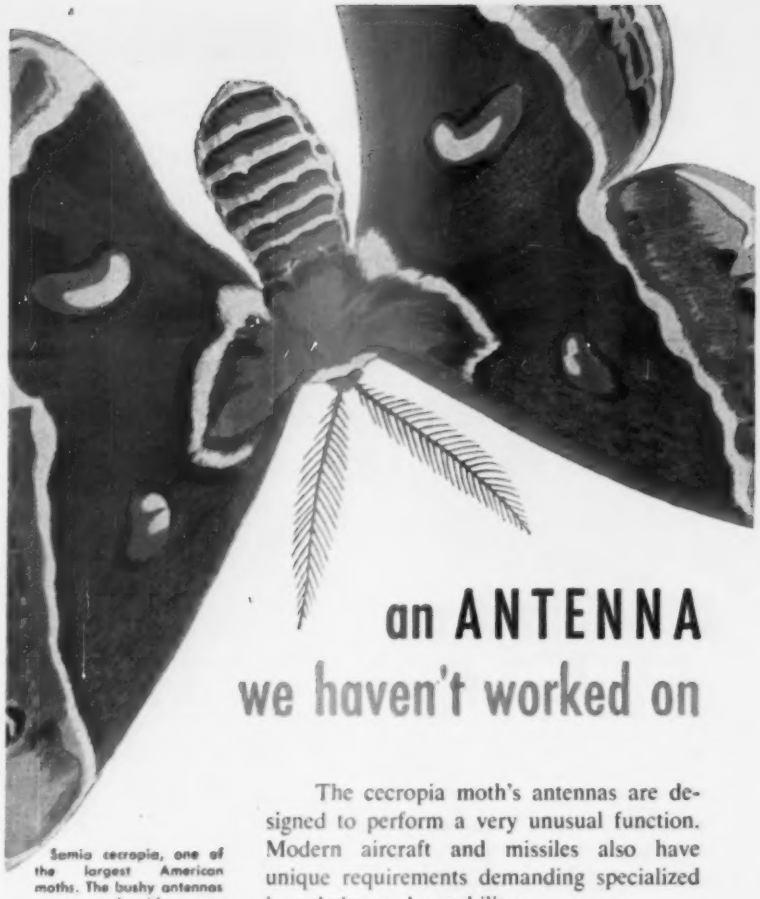

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The Clemco Aero Products radiation resistant linear hydraulic actuator was designed for the coarse control of an atomic engine which uses a Clemco Aero Products rotary hydraulic actuator for the vernier control.

This is a double ended unit with a piston area of .44 square inches and a 40 inch stroke for operation in a 3000 P.S.I. hydraulic system. Snubbing is provided for the final two inches of stroke in both directions.

All materials with the exception of the low pressure seals, which are asbestos graphite, are inorganic. The high pressure rod seals are an all metal segment type, and the piston is sealed with metal piston rings. Internal leakage at a pressure differential of 3000 P.S.I. is less than .15 G.P.M. Pressure to start motion is 60 P.S.I.

The basic design and materials used in this unit render it applicable for high temperature as well as radiation resistant uses.

TEMPERATURE AND RADIATION RESISTANT ROTARY ACTUATORS

The basic design of the extremely efficient Clemco Aero Products Rotary Hydraulic Actuator is readily adaptable to applications requiring operation under conditions of high temperature and or radiation.

The vane and abutment seals do not rely on elasticity to perform their function so the material choice is almost unlimited. Efficiencies better than 90% are attained even though the coefficient of friction of the inorganic materials used is considerably greater than the teflon used in the standard Clemco Aero Products rotary actuator, and internal leakage and backlash can be held to very small values.

Viton A "O" rings are excellent external seals for applications where temperatures do not exceed 500° F. and radiation is not present. For higher temperatures and or radiation, the rotating output shaft lends itself to the use of metal bellows face seals which are considerably more efficient and reliable than any of the all metal seals developed for reciprocating output rods to date.

In applications where an appreciable difference between ambient and fluid temperatures exist, the rotary actuator output shaft does not move from the ambient temperature into the fluid as does the output rod of a linear actuator. This action in a linear actuator prevents temperature stabilization as well as penalizing the fluid.

The Clemco Aero Products rotary actuator also operates satisfactorily when hot gas is the fluid medium.

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AVIATION CALENDAR

(Continued from page 5)

play and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.

Sept. 7-9—Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass. Sponsors: Instrument Society of America; American Society of Mechanical Engineers; American Institute of Electrical Engineers; Institute of Radio Engineers; American Institute of Chemical Engineers.

Sept. 8-9—1960 Engine and Operations Symposium, Airwork Corp., Millville, N. J.

Sept. 8-10—1960 National Convention, OX-5 Club of America, Tower Hotel Courts, Dallas, Tex.

Sept. 12-16—16th Annual General Meeting, IATA, Copenhagen, Denmark.

Sept. 12-16—Second International Congress, International Council of the Aeronautical Sciences, Zurich, Switzerland.

Sept. 14-16—Annual Meeting, National Assn. of State Aviation Officials, Wort Hotel, Jackson, Wyo.

Sept. 15-16—15th Annual Meeting, Armed Forces Chemical Assn., Sheraton-Park Hotel, Washington, D. C.

Sept. 15-16—Eighth Annual Engineering Management Conference, Morrison Hotel, Chicago, Ill.

Sept. 19-22—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, Shoreham Hotel, Washington, D. C.

Sept. 20-22—13th Annual Meeting & Forum, National Business Aircraft Assn., Ambassador Hotel, Los Angeles, Calif.

Sept. 21-25—National Convention and Aerospace Panorama, Air Force Assn., Civic Auditorium and Brooks Hall, San Francisco, Calif.

Sept. 25-27—24th Annual Convention, International Northwest Aviation Council, Harrison Hot Springs, British Columbia.

Sept. 27-30—Space Power Systems Conference, American Rocket Society, Miramar Hotel, Santa Monica. Cosponsors: USAF; U. S. Army; U. S. Navy; NASA; AEC.

Oct. 2-10—Federation Aeronautique Internationale Annual Meeting, Barcelona, Spain.

Oct. 3-5—Sixth National Communications Symposium, Institute of Radio Engineers, Utica, N. Y.

Oct. 3-5—Seventh Annual Meeting, Institute of Radio Engineers' Professional Group on Nuclear Science, Gatlinburg, Tenn. Cosponsor: Oak Ridge National Laboratory.

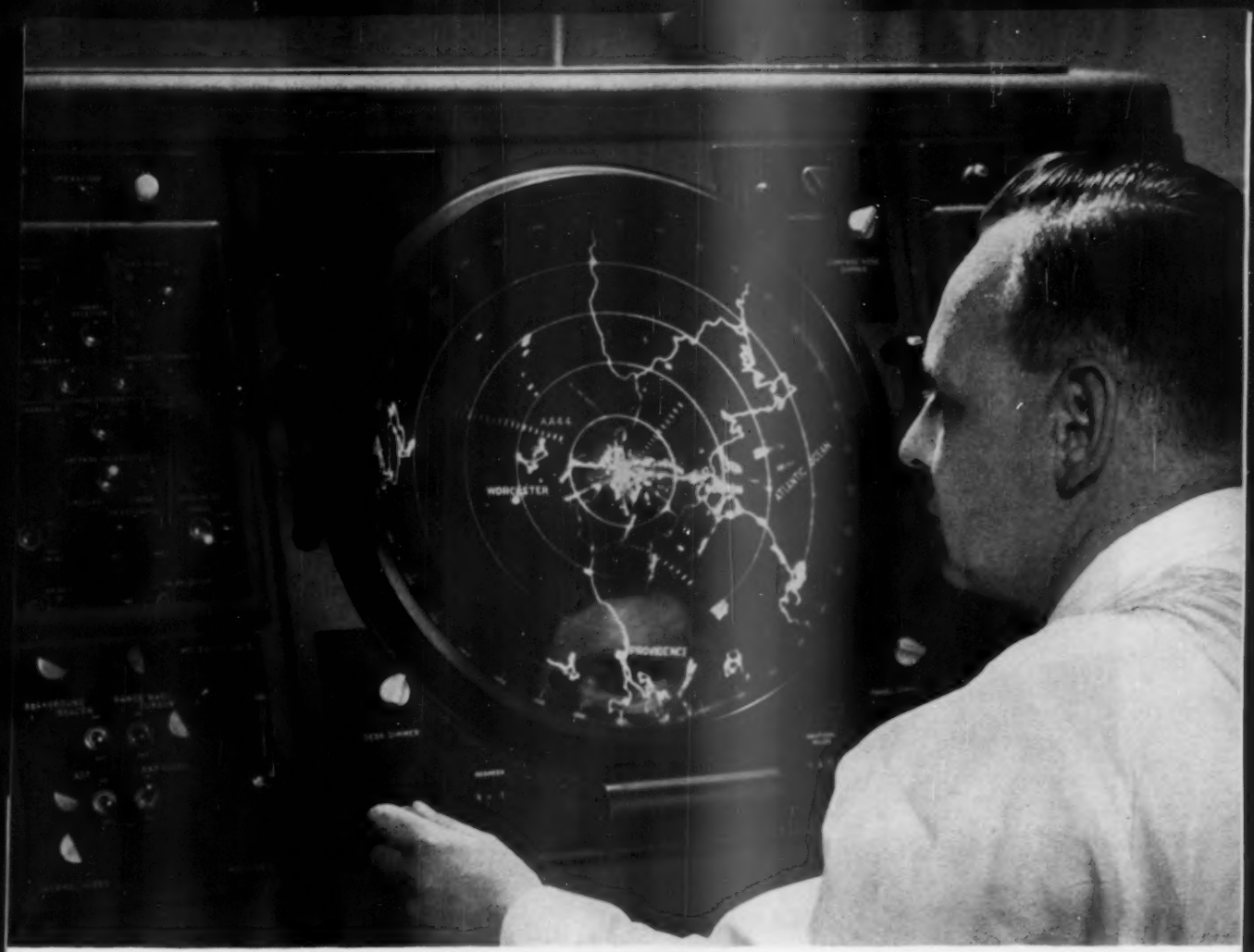
Oct. 3-5—National Midwestern Conference on Air Logistics, Institute of the Aeronautical Sciences, Tulsa, Okla.

Oct. 3-5—First International Air Traffic Control Conference and Fifth Annual Meeting of the Air Traffic Control Assn., Sheraton-Palace Hotel, San Francisco.

Oct. 5-7—Briefing Session on Opportunities in Space-Age Technology, American Management Assn., Hotel Astor, New York, N. Y.

Oct. 6-8—Annual Convention, Airmail Pioneers, El Cortez Hotel, San Diego, Calif.

Oct. 6-9—Annual Meeting, National Pilots Assn., Western Hills Lodge, Wagoner, Okla.



Raytheon's New Scan Conversion System Provides Memory, Brightness, Alpha-Numerics, Instant Erase

Raytheon's New Scan Conversion System achieves and improves air traffic control with: continuous . . . accurate . . . bright display of all target-in-area information. MEMRAD, the display's two-gun cathode ray tube, stores, converts, and projects radar data on any number of TV monitors. Image is 300 times brighter than conventional PPI. Targets show as continuous trails from which speed, position, direction may be read or transmitted electronically.

The display also provides instant image erase, and generation of alpha-numeric symbols that lock on and move with target automatically. Masks, subnormal room illumination, all human error related to oral-manual plotting are eliminated. Superimposition of maps, off-centering, large screen TV projection make Raytheon's SCS the vital element in more sophisticated systems.

RAYTHEON EQUIPMENT DIVISION

Excellence in Electronics

For Raytheon Scan Conversion Brochure,
Write: Director of Marketing, Equipment Division, Dept. A1, Raytheon Company, West Newton, Mass.

BENDIX REPORTS ON ITS SUPPORT EXPERIENCE

Bendix mobile computer-tester cuts B-58 flight control system checkout time from 2 days to 90 minutes

TETERBORO, N. J. — Helping to keep U. S. weapon systems mission-ready is this Bendix computer-on-wheels. It rolls right up to the flight line where, in 90 minutes, it runs through 750 static and dynamic tests on the flight control system as installed on the USAF Convair B-58. By comparison, the previous procedure required two days' work by three men just to make *spot* static tests. This automatic equipment, although designed for the B-58, can be modified to test any other weapon system.

TETERBORO AND SOUTH BEND

Whether your support equipment needs are commercial or military—airborne or ground—you can count on *proved* Bendix experience in systems engineering and analysis, controls, aircraft and missile systems, computer functions, and field service to supply quick, efficient answers.

Bendix Support Equipment-Teterboro—brings over 40 years' such experience to the creation of *electronic* and *electromechanical* support equipment. Specific operating fields include:

BENDIX

Hydraulic and pneumatic calibration equipment, one of the many fields of checkout and support equipment designed and produced by Bendix.

Bendix test stand checks and calibrates fuel control equipment for jet engines

SOUTH BEND, IND.—Bendix fuel control test stands reproduce operating conditions such as RPM, altitude, fuel flow, temperature and pressures required for critical testing and calibration of all propulsion control systems —both systems now in use and planned for the future.

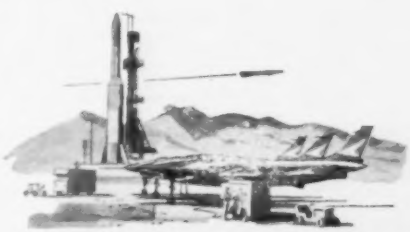
The reliability, versatility and ease of operation inherent in the Bendix test equipment springs from a position of knowledge and experience which is unique in the industry. Since the beginning of the aircraft era, Bendix has actively engaged in the design, development and production of fuel control equipment for all major engine manufacturers. Bendix test stands are now in use at military, airline and commercial installations around the world.

SUPPORT CAPABILITIES EXTEND ACROSS THE BOARD

manual and automatic checkout equipment; adaption equipment; coordinated modules of both checkout and adaption as complete systems; training devices and simulators; and monitoring equipment.

Bendix Support Equipment-South Bend—draws on its 35 years' aviation and automotive experience to produce *hydraulic, pneumatic,* and *mechanical* support equipment. Its operating areas include: silo, above ground, and shipboard launchers; transporter systems and sub-system components; missile erection equipment; handling, hoisting, jacking, and lifting equipment; test equipment and complete test facilities; and hydraulic and pneumatic power generating and supply systems.

Find out today how this vast array of *proved* systems experience can help solve your specific support problems.



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TETERBORO, N. J. **SOUTH BEND, IND.**

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- Manual Over-Ride—at Valve or Remote
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- Radio Noise Filter
- Idling or Over-Travel Linkage
- Upstream Seal
- Internal or External Ground

FROM STOCK PARTS. 3/4" to 3" gate valves readily available in manually operated and motor-driven configurations to meet all requirements of MIL-V-8608. For use with fuel, water, oil, hydraulic fluid...or, with special seals, for highly corrosive fluids.

SUBMERGED PLUG VALVE. Available in any line size from 3/4" to 2"...for virtually any fluid medium.

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Most variations are combinations of normal parts, and General Controls' unique method of sealing and fine mechanical clutches provide inherent reliability—a fact fully substantiated by field operation records of aircraft, missiles and rockets.

General Controls is the world's largest manufacturer of motor-driven gate valves—producing the greatest variety in existence.

General Controls Gate Valves have been supplied to **every** airframe manufacturer in the U.S. and Canada...and because all parts are engineered and built in General Controls' own advanced facilities, airframe makers receive fast service...achieve real price advantages.

General Controls engineers are readily available to discuss your applications for fluid or electromechanical controls of all kinds.

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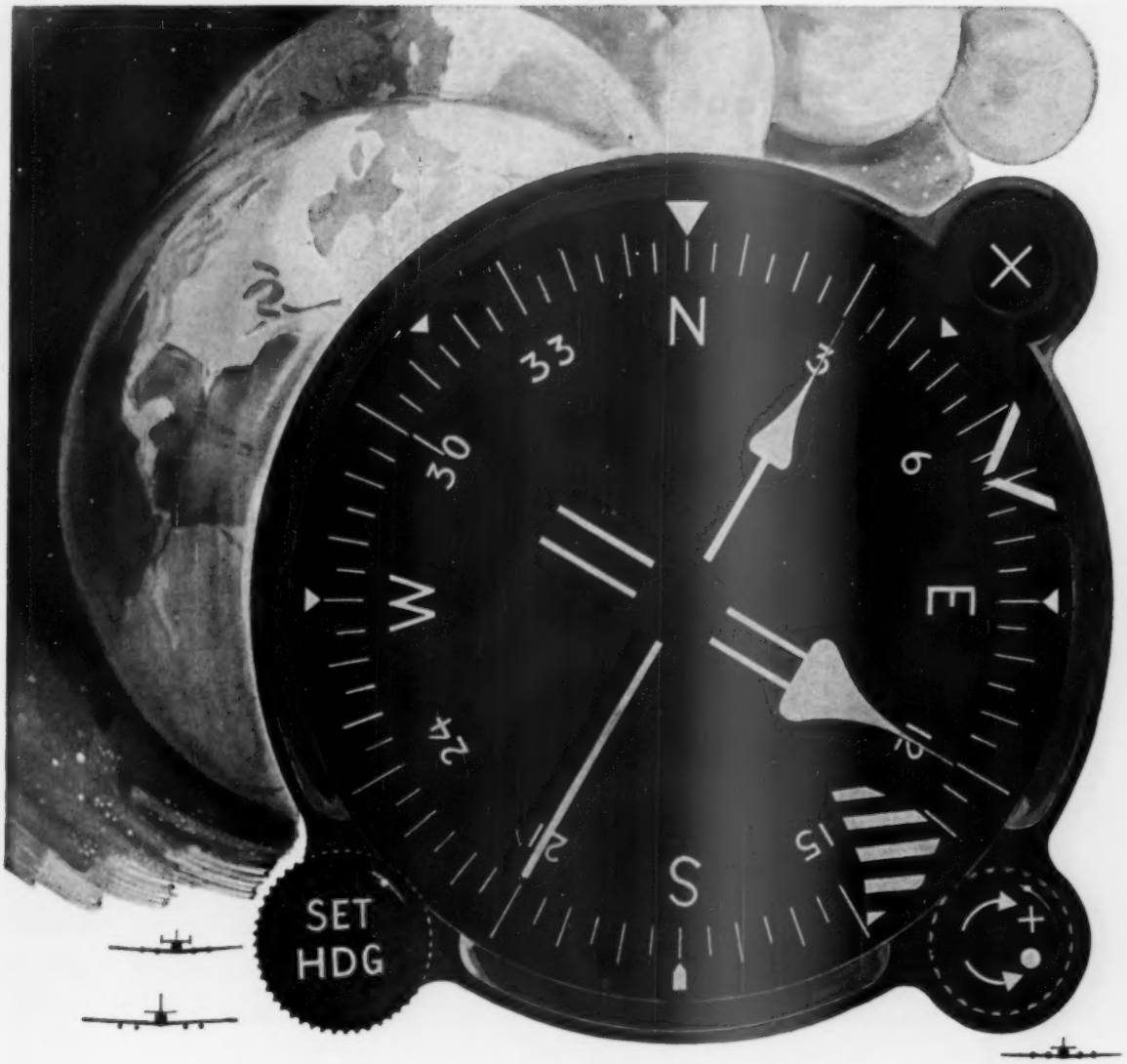

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...the heart of precision navigation

The directional gyro continuously synchronized to the earth's magnetic field . . . the Sperry Gyrosyn® Compass that revolutionized heading information for flying when it was introduced in 1944 . . . is still at the heart of precision aircraft navigation. Today there is a Gyrosyn Compass System for all types of aircraft – military, commercial, executive and private.

The Gyrosyn combines the functions of both a directional gyro and a magnetic compass. The differences in the particular models–which include the C-2, C-4, C-8, C-9, C-10 and C-11–relate to size, weight, performance and cost consistent with the application.

The C-2 is the lightest and most compact system available, weighing only 8¼ pounds. The transistorized C-11 incorporates Rotorace® suspension to hold random drift within ± 0.5 degrees an hour in "free-gyro" operation on transpolar routes. As Doppler navigators come into widespread use, Gyrosyn systems will be a "must" in meeting critical accuracy requirements.

Sperry has produced and sold more high-accuracy compass systems than all other manufacturers combined.

SPERRY

SPERRY PHOENIX COMPANY, *DIVISION OF SPERRY RAND CORPORATION, PHOENIX, ARIZONA*

Weld failures cut 89% using vacuum-melted filler wire

[*Weld tests on alloy steel wire used in missile applications revealed nine times as many failures with air-melted wire as with Cannon-Muskegon vacuum-melted wire.*] [*Superior to consumable-electrode melting, Cannon-Muskegon vacuum-induction melting greatly reduces gas levels (nitrogen less than 25 ppm, oxygen less than 25 ppm, hydrogen less than 5 ppm). Combined sulphur and phosphorus run less than .015%.*]

[*These remarkably low gas and impurity levels can be most efficiently obtained with Cannon-Muskegon vacuum-induction melting. You are invited to write Cannon-Muskegon for further details.*]

☛ [*Among test samples prepared from air-melted wire, 18 out of 32 failed at the weld.*]

☛ [*Among similar samples prepared from the vacuum-melted wire of the same grade, only two out of 32 bars failed at the weld.*]

[*Different alloys of Cannon-Muskegon vacuum-melted welding wire are available in sizes from 1/32" to 1/8", in 36" cut lengths, or in 10 or 25-lb. spools packed in airtight Argon-filled steel containers.*]

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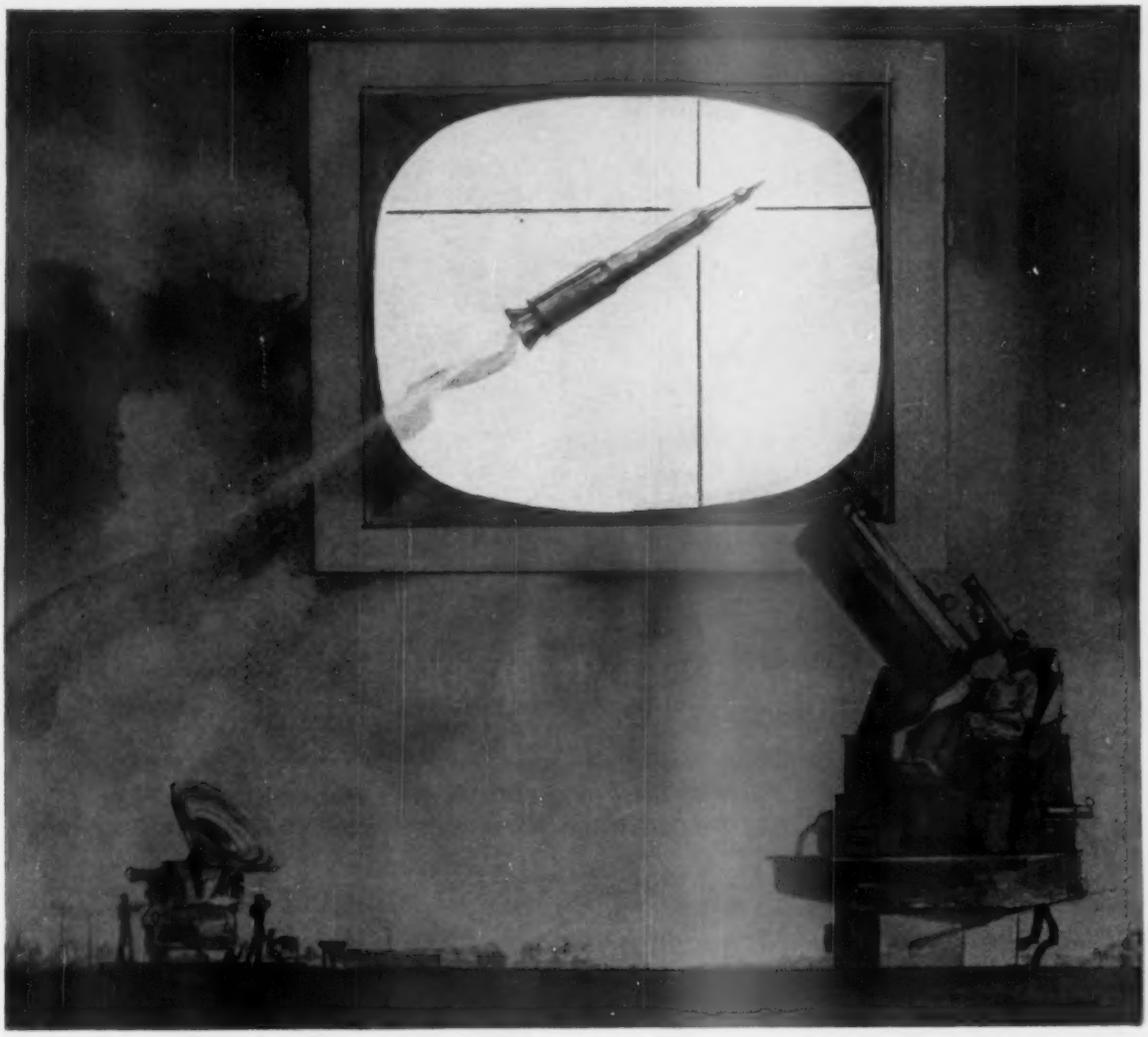

Pursuit by a TV private eye...

The eye on the missile that streaks across the sky is the television camera . . . part of the Norden TV theodolite, developed in cooperation with ARDC's Air Proving Ground Center, Eglin Air Force Base. This automatic eye follows the target even with poor contrast between the target and its background of sky.

Once the tracking operator is on target optically his TV camera is also on the target, which it displays on a small monitor. The picture simultaneously appears on a large TV console monitor. The console operator sets cursor lines on this screen and the TV theodolite locks on target. From this point, target tracking and data transmission are automatic.

By equipping this tracking equipment with a TV eye and TV screens that mirror the eye's image, by applying engineering skills and experience to development of the TV theodolite, Norden continues to extend man's capabilities.

• • •

Stimulating positions are available at all levels of responsibility for qualified engineers and scientists.

NORDEN

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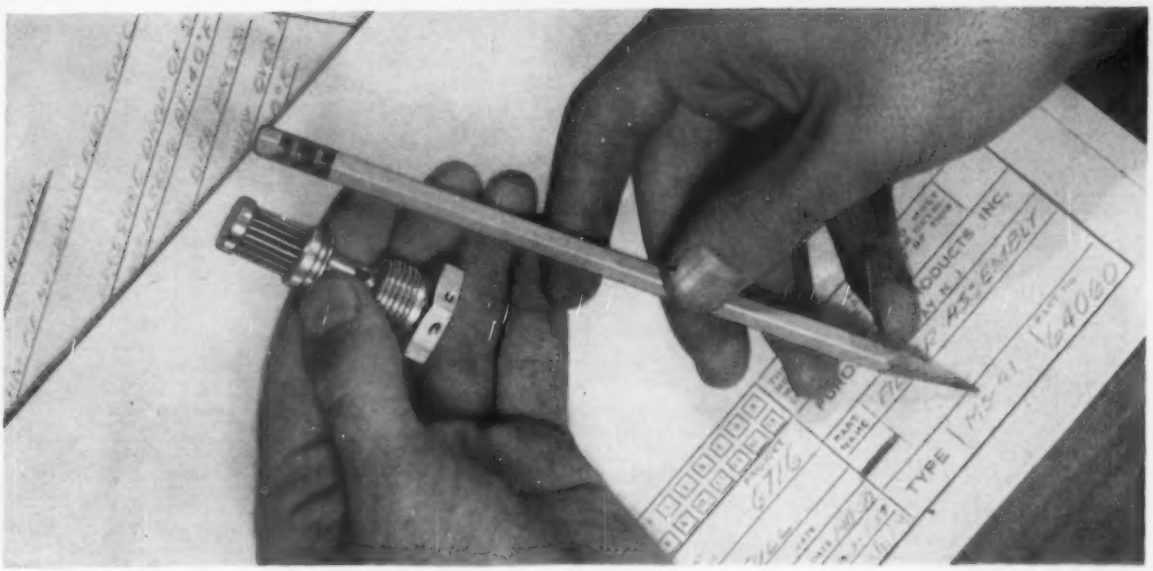

Miniaturized cavity-type filter packs 4.2 square inches of filtering area into 1" x 9/16" element

Purolator develops thumb-nail size element to protect hydraulic control circuits on Army's Hawk Missile mobile launcher.

How small can you make an element that must filter 2 gpm hydraulic oil at 2500 psi at any temperature within a 315° range? Purolator's new miniature cavity-type hydraulic filter is the best answer to date. Here's why:

4.2 square inches of convoluted stainless steel wire cloth are packed into this miniature filter. This element, which weighs 0.25 ounces, filters two gallons per minute of hydraulic oil, at temperatures ranging from —40° to + 275° F. The element will withstand 2500 psi differential pressure without collapsing.

The element is made up of a total of ⅛-mile of stainless steel wire, woven into wire cloth and convoluted to extend filtration area. This element will remove 98% of all particles whose two smallest dimensions are larger than 10 microns, and 100% of all particles measuring 25 microns or more.

The picture at the top of the page shows you the complete filter assembly, ready for installation in the hydraulic control system. The overall length of the unit is 2 1/32"; maximum overall diameter is 1". Total weight is slightly over 1 ounce. Designed as a cavity-type unit, the filter is installed simply by screwing it into the hydraulic system so the filter element intercepts oil flow. The element can be removed, cleaned and replaced without special tools.

The picture at right shows the mobile launching platform for the Hawk Missile. The compactness and mobility of the

launcher, and the probability that it would be subjected to severe jolting, made it necessary to specify as small a filter as possible, and one that could be integrated with the rest of the system for maximum simplicity and durability.

The Purolator engineers who developed this new miniature cavity-type filter are available now to design a filter to meet your specifications. Simply contact Purolator Products, Inc., Department 3096, Rahway, New Jersey.

Filtration for Every Known Fluid **PUROLATOR**

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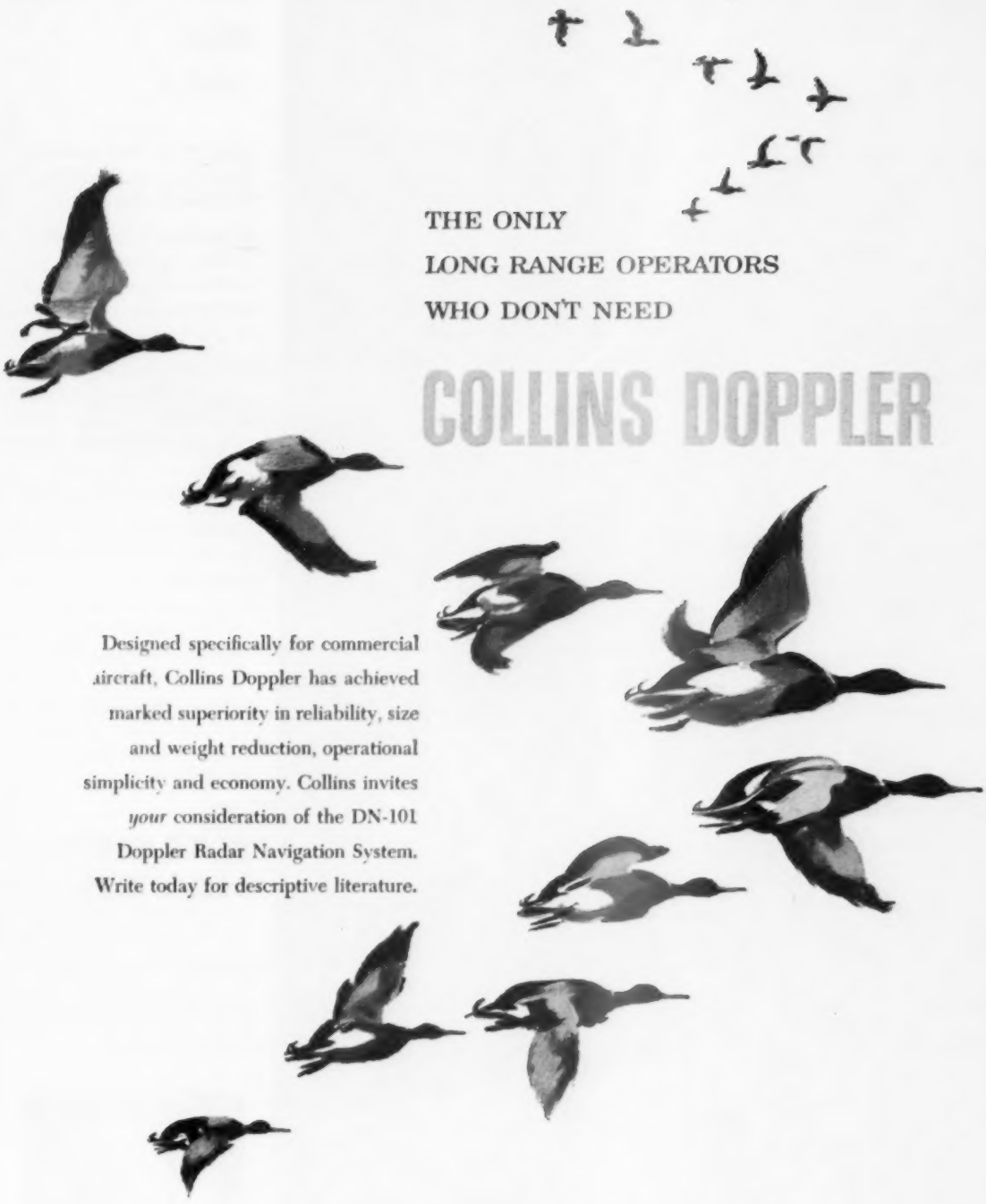
RAHWAY, NEW JERSEY, AND TORONTO, ONTARIO, CANADA



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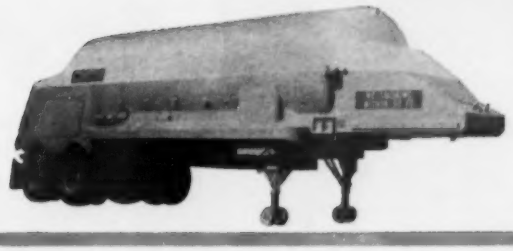

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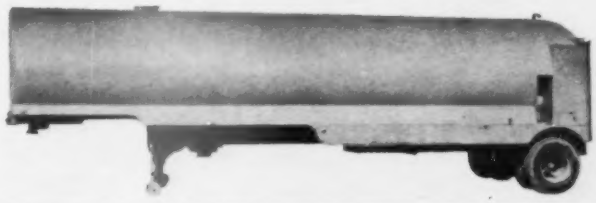

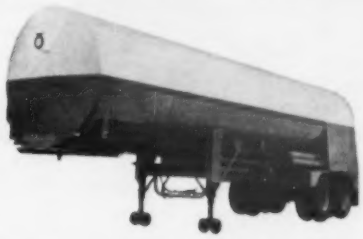

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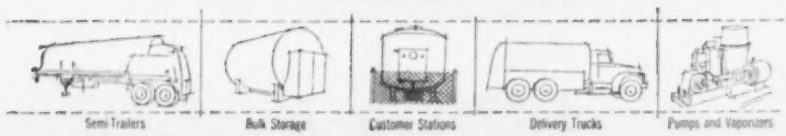

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For complete information and specifications, write for Data File AW-1162-1.

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▶ Twelve regional commanders will be assigned to speed Atlas, Titan bases toward operational status.

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COVER: Boeing B-52G is used as experimental testbed for prototype Pratt & Whitney Aircraft YTF-33-P-1 turbofan engines which will be installed on all B-52H series aircraft. While the new engines are 480 lb. lighter than the J57-P-43W engines now installed on many other supersonic aircraft as well as the B-52G, they will produce more thrust and increase proficiency.

PICTURE CREDITS

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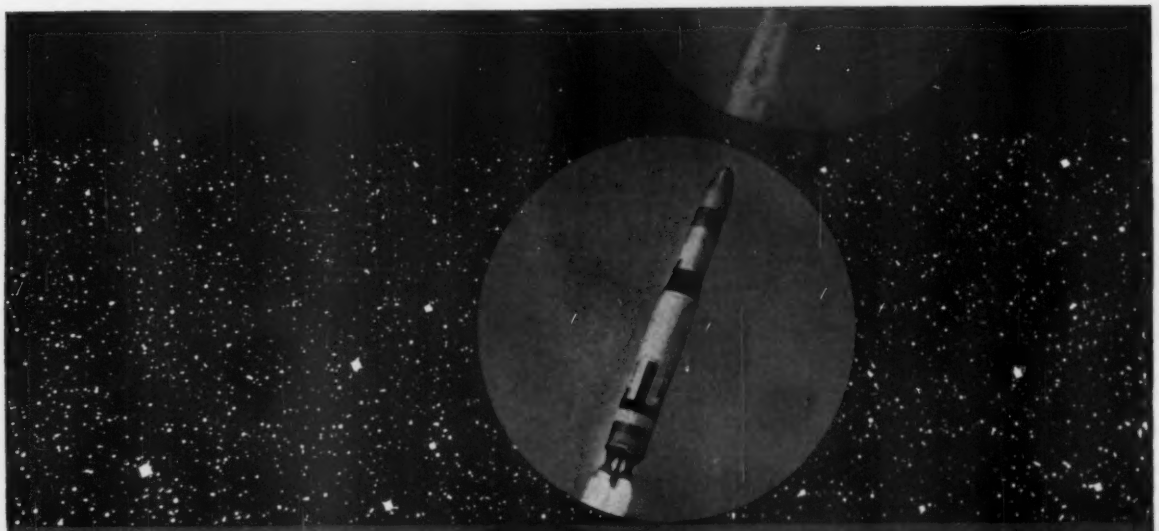

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The strength and prestige of this nation depends upon many things . . . important among these are the successes of the Air Force Ballistic Missile Program and related advanced space projects.

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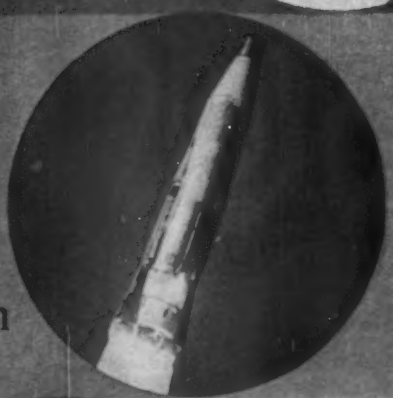

In building strength upon strength in the race for space technology leadership, the knowledge and experience gained from Atlas, Thor, and Titan ballistic missile systems development is being applied to advance Minuteman. For these programs, under the management of the Air Force Ballistic Missile Division, Space Technology Laboratories has had the direct responsibility for over-all systems engineering and technical direction. As these ballistic missile and related space programs go forward, STL continues to contribute technical leadership and scientific direction.

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EDITORIAL

Defense Is Now a Key Issue

The Nixon-Rockefeller agreement on key planks of the Republican party's 1960 presidential platform has ensured national defense a place in the coming election campaign as one of the key issues. The Nixon-Rockefeller agreement resulted in a substantial strengthening of the Republican defense plank (see Congressional Editor Ford Eastman's detailed on-the-spot report from Chicago on page 28) although it did not emerge as strong as Governor Nelson Rockefeller's earlier position on the defense problem. This compromise in the direction of a stronger defense plank at Chicago indicates that the Republicans recognize they cannot stand entirely pat on their record and must take a fresh and more vigorous approach to the increasingly crucial problems of our national defense posture.

It is now apparent that both political parties are acutely aware that national defense is a burning issue with the American people and that it is a problem that no public office seeker can safely ignore in the fall election campaign. In fact, it is pretty obvious now that the American voter's opinion of how either political party will handle the defense problems facing this country in its historic struggle with the Soviet Union will be an extremely important yardstick in the millions of decisions that will be made in the secrecy of the voting booths across the country on November 8.

It is a hopeful sign that both parties recognize in their platforms that there is no price ceiling on this country's security and at the same time are in agreement that more money is not necessarily a quick or effective solution but that far more efficient management of our defense resources is urgently required. Both parties also recognize in their platforms that the impact of technology has outmoded many of our traditional military approaches to the defense problem.

Emphasis on the Future

This provides a good base from which to generate an intelligent discussion of our future defense problems in the fall campaign. It will serve little purpose to attempt to pin party labels on our major defense errors of the postwar period. There have been plenty under both banners. The ill-timed defense economy wave of 1949 by the Truman Administration just before the Korean war began was just about as far off the beam as the present Administration's stubborn failure to recognize the growing challenge of Soviet military technology in jet aircraft, ballistic missiles and space technology during the mid-1950s.

Oddly enough, neither presidential candidate has identified himself strongly with the defense issue until recently. Senator Kennedy was conspicuous by his absence in the great national defense debates of the past few years until he plunged into the missile gap controversy briefly last fall. Vice President Nixon has several times assayed an attempt to take a stronger position on defense issues in the post-Sputnik era but each time has been dragooned back into silence by his superiors.

Candidates' Experience

Both Senator Johnson and Henry Cabot Lodge have had considerably more day-to-day practical experience with the realities of the Soviet threat and methods of combating it than their superiors on the party tickets. Senator Johnson in his leadership of the Senate and his work with the preparedness and space committees has taken a leading role in shaping the strong defense policies that have emerged from the Congress during the past few years. Ambassador Lodge in his role as permanent U.S. representative at the United Nations has done an outstanding job in grappling with the Soviets on the multitude of thorny issues that regularly appear before that body. He also played an active role in the Armed Services Committee during his tenure in the Senate. It may be that because of the outstanding backgrounds of both vice presidential candidates in defense problems, this office may play a more important role in this area for the 1961-64 Administration.

Certainly the defense problems of this period are going to demand a heavy degree of concentration by the chief executive and his principal assistant if any degree of success is to be achieved toward their solution. This concentration will require a more thorough understanding of the modern technology that has revolutionized military science since the end of World War II and more frequent direct contacts with the military leaders who have operational responsibility in such key areas as Strategic Air Command, the joint commands overseas or in the direction of research and development efforts. A three-hour trip around Cape Canaveral or a few minutes at the wheel of a nuclear-powered submarine cannot be considered adequate briefing for a chief executive facing the defense problems of the future.

Both slates of candidates have an excellent opportunity to demonstrate to the voters of this nation their proposed programs and policies on the defense issue. They should provide the voters with the best possible base of comparison on which to make their judgments of which pair would do the better job of steering a sound and courageous course on the defense issue.

This is an encouraging and healthy prospect for the nation.

—Robert Hotz

BURGOYNE IGNORES RECONNAISSANCE AND INVITES DISASTER

General "Gentleman" John Burgoyne was not one to fret over reconnaissance.

Saratoga, frequently called the turning point of the American Revolution, was the end product of a series of "no reconnaissance" battles fatal to Burgoyne's invasion force. Supremely confident as he swung southward from Canada, the British commander rarely knew where or what was ahead. St. Leger's British force, vital element in Burgoyne's campaign, disintegrated when its sizable Indian contingent vanished at news of a huge American counter force. Reconnaissance would have readily shown the Americans mustered a mere 1,000 men. Along his march, Burgoyne dispatched his grenadiers to reinforce a Hessian advance unit at Bennington . . . as usual, without adequate reconnaissance. The grenadiers did not discover until after they were decimated by a Colonial force that the Hessians had already been wiped out. Finally, Burgoyne's confused and weakened men, alone and completely ignorant of enemy forces, surrendered at Saratoga.

Throughout the history of warfare, successful field commanders have based command decisions on proper reconnaissance. Burgoyne ignored history and the obvious need for strategic and battlefield reconnaissance thus committing a series of faulty command decisions and helping to assure the success of the American Revolution.

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WHO'S WHERE

In the Front Office

George Romney, a director, Douglas Aircraft Company, Inc., Santa Monica, Calif. Mr. Romney is president of American Motors Corp.

Frank P. DeLuca, Jr., president, Acoustica Associates, Inc., Los Angeles, Calif., succeeding **Robert L. Rod**, now board chairman.

Morton F. Spears, a director and vice president-engineering, Pickard & Burns, Inc., Needham, Mass.

George H. Nibbe, a director, Missile Systems Corp., Los Angeles, Calif. Mr. Nibbe is president of Canoga Corp., a subsidiary of Underwood Corp.

Ira Kamen, president, Portland Industries Corp., South Portland, Me.

Orren L. Jones, former Washington representative for Model Engineering and Manufacturing Co., Inc., now vice president-Eastern Division. Also: **William E. Hughes**, vice president-marketing.

Edward H. Heinemann, formerly vice president-European Division of Douglas Aircraft Co. (AW July 25, p. 35), executive vice president, Summers Gyroscope Co., Santa Monica, Calif.

Ellie Jones and **Raymond J. Stepanek**, directors, Space Corp., Dallas, Tex. Mr. Jones is the company's vice president-contracts; Mr. Stepanek, vice president-manufacturing.

George D. Butler, a vice president, International Resistance Co., Philadelphia, Pa. Mr. Butler continues as director of marketing.

R. C. Chapman, executive vice president and a director, Crescent Engineering & Research Co., El Monte, Calif.

Hyman B. Freehof, Examiner-in-Chief, U. S. Patent Office, Department of Commerce.

Albert J. Weatherhead, III, vice president and general manager, Special Products Division, The Weatherhead Co., Cleveland.

Jerome L. Strauss, vice president and general manager, Budd Electronics, Inc., Long Island City, N. Y., a Budd Co. subsidiary.

Francis W. Dunn, assistant to the president for public relations, Bell Intercontinental Corp., South Bend, Ind.

George Clement, assistant to the president, The Rand Corp., Santa Monica, Calif.

Col. John R. Medberry, chief of Air Materiel Command's Los Angeles (Calif.) Air Procurement District. **Col. Robert E. Lee** replaces Col. Medberry as chief of the Legislative Liaison Division at AMC Headquarters.

William E. Guilian, general counsel, and **John H. Warden**, patent counsel, National Aeronautics and Space Administration's Marshall Space Flight Center, Huntsville.

Honors and Elections

Dr. Otto Halpern, distinguished scientist and currently a consultant to the Lawrence Radiation Laboratory, has received the Distinguished Public Service Award from the Department of Defense for "his exceptionally meritorious contributions to the security of the United States. . . ."

(*Continued on page 96*)

INDUSTRY OBSERVER

► Soviet scientists are working intensively on communications satellites, with primary emphasis on synchronous (stationary) passive reflectors in 22,000 mi. equatorial orbits. Soviets plan to use a "cloud-like reflector" to provide higher gain and permit use of lower-powered earth transmitters than NASA's spherical passive satellite would. Soviet reflector may consist of a web or net of dipole reflectors, oriented to catch signals from earth.

► **Silos and underground control centers for first three squadrons of Minuteman missiles will be connected by cables, but succeeding installations probably will use "unwired" earth current scheme (AW May 18, 1959, p. 26). Wired installation for three squadrons costs approximately $10 million for cables and $20 million for trenches and cover.**

► Nimbus I weather satellite's sophisticated sensory system will include a vidicon system providing almost complete coverage of the globe; electrostatic tape subsystem to permit higher resolution studies of hurricanes, etc.; triple infrared subsystem with 5-mi. high resolution sensors for night cloud cover, 30-mi. medium resolution sensors for radiation measurements, and 300-mi. low resolution heat-balance sensors. It also will measure the solar constant and solar ultraviolet and particle radiation. Launch is expected late next year.

► **Selection of a contractor for the GJQ9 test set adapter for the USAF-Douglas Skybolt air-launched ballistic missile is imminent. Motorola and Packard-Bell appear to be favored among the 19 firms that submitted bids to Northrop's Nortronics Division, subcontractor to Douglas for guidance.**

► Orbital radio reflector consisting of thousands of tiny metal needles is being studied by Massachusetts Institute of Technology under Defense Department sponsorship. Needles would fan out to provide an extremely large, efficient reflecting surface. They would be designed to present no collision hazard and no interference for radio astronomy or space radio experiments. Trials are expected within a year in a "piggyback" payload.

► **USAF has been asked to submit a program for development of a satellite rendezvous vehicle, including experimental launches, to Defense Department. Goal is to develop close-approach techniques. Then design of inspector satellites carrying television, infrared cameras and/or nuclear radiation counters, or interceptor satellites with kill capability, should be relatively easy, Defense believes. USAF has probed the idea under the Saint (Satellite Inspection and Interception) project.**

► Limited procurement of Nike Zeus anti-ICBM missiles for point defense of a few critical areas is gaining increased support in Defense Department. USAF's proposal for a lower cost point defense anti-ICBM, known as Project Cheapie, has little support because of effort and funds already put into Zeus program.

► **Possible radiation hazard posed by re-entry into the atmosphere of a nuclear reactor from a satellite's power system will be investigated by Avco under a contract from Wright Air Development Division. Avco hopes to develop techniques for simulating conditions of such a re-entry.**

► Defense Department sanction for implementation of USAF's program for small, mobile ICBMs (AW July 18, p. 26) will depend on "foolproof" control system to prevent firing by enemy agents from any of thousands of truck transporter-launchers. Second phase of the study, which contemplates operation of such missiles in 1970, is expected to receive more serious consideration than early phase, which would have missile ready in 1965, conflicting with Minuteman's availability.

► **Image enhancement equipment being developed for Army by FMA, Inc., for identification of mine fields is proposed for use in space to identify and interpret, by direct scope-viewing, physical phenomena normally undetectable on photographic or video displays. System, expected to have a 2,000-line resolution capability, should give better definition and speed the examination process.**

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Washington Roundup

The Defense Issue

The importance of defense as an election year issue was obvious last week in Republican jockeying over the platform. Presidential nominee Richard Nixon evidently wanted something stronger than the Eisenhower defense record to run on. He got a platform plank liberal enough to give him considerable leeway during the campaign.

The only question now is how much the defense effort will be increased when a new Administration takes over in January. Both Democrats and Republicans are now on record for a bigger effort, although the Democrats take a stronger stand.

Nixon went a long way toward adopting the defense philosophy of New York Governor Nelson Rockefeller, which is very similar to the Democratic position. Conservative forces managed to tone the defense plank down some, but it strongly implies a change in the magnitude of the defense effort. Apparently Nixon sensed a rising public interest in the issue and didn't want to be tied to a potentially unpopular stand-pat platform.

President Eisenhower approved the defense plank in the Republican platform, but he made it clear he still stands on his record. He told the convention there is room for program changes to meet changing conditions, but basically he concentrated on defending the defense policies he has followed during his years in the White House.

Top Defense Department scientists got a progress report on the Project Defender ballistic missile defense research program last week. This Advanced Research Projects Agency project reportedly has produced considerable new knowledge on the radar and infrared radiation signatures of ballistics missiles. This kind of data is fundamental to any successful missile detection and defense program.

New information is valuable, but nothing verging on a technological breakthrough in ICBM defense concepts.

Mail Airlift Threat

Postmaster General Arthur Summerfield called airline officials to Chicago last week for a conference on the Cunningham Bill. This legislation would prohibit airlift of any mail not carrying an airmail stamp. The House approved it, but it is expected to hit tougher sledding in the Senate.

Summerfield outlined intensive efforts by the railroads that went into pushing the bill through the House and described pressures the rail carriers are applying in the Senate. It was apparent that airlines would have to mount a counterattack in the Senate during the August session.

Summerfield also told the airlines that the Post Office Department is willing to accept Civil Aeronautics Board rates for surface mail airlift. He said the Post Office is not pushing for authority to negotiate rates with individual carriers.

Negotiations on a nuclear test ban took a small step forward last week when the Soviet Union offered to permit three inspections a year in its territory. These inspections would be made by international teams investigating possible violations of a nuclear test ban treaty.

This inspection provision is too limited to win acceptance by the U. S. and Britain. But it is regarded as a sign of Soviet interest in serious negotiations after dodging the issue of definite inspection quotas since April, 1959.

Study of Aerospace

House Government Military Operations Subcommittee is studying the organization and role of Aerospace Corp. Last year this group, headed by Rep. Chet Holifield, objected to Space Technology Laboratories' ties with Thompson Ramo Wooldridge. These objections led to replacement of STL by Aerospace Corp. as Air Force Ballistic Missile Division's technical arm.

Cold war tensions were evident in reports of Communist boldness around Berlin and over U. S. bases in Spain. Both White House and State Department denied stories that the U. S. had intelligence reports warning of a significant increase in Soviet military strength around Berlin and of plans to move against West Berlin within 30 days.

Air Force denied a report that Czechoslovakian Il-18 turboprop transports flying to Conakry in Guinea were chased away from U. S. bases by Spanish and U. S. interceptors. Czech transports are reported to have wandered from prescribed routes several times in attempts to fly over U. S. bases in Spain and Morocco.

Strategic value of the growing Soviet fleet of long-range turbine transports was demonstrated when three Il-18s flew 6,800 mi. to the Congo, each carrying close to nine tons of food. The Il-18s also carried Ghanian troops to the Congo to join the United Nations force.

—Washington Staff

AMC Plans ICBM Site Activation Force

Twelve regional commanders will be assigned to speed Atlas, Titan bases toward operational status.

Washington—Moving fast to implement its new responsibility in the ballistic missile program, Air Materiel Command will delegate 12 senior Air Force colonels as site activation task force commanders at the various Atlas and Titan deployment locations under construction across the country, to iron out obstacles and maintain speed in all phases of effort toward operational capability.

The task force commanders will report directly to Maj. Gen. Thomas F. Gerrity, new commander of AMC's Ballistic Missile Center, Inglewood, Calif. With his new assignment scarcely a week old, Gen. Gerrity already has briefed AMC on the projected detailed action BMC will take in its new responsibility.

Management responsibility for this ballistic missile site activation job was delegated to AMC after eight months of review, re-evaluation and deliberation by a team of about a dozen general officers from Air Research and Development Command, Air Materiel Command and Headquarters, USAF, functioning as the Anderson Board. Headed by Gen. Samuel E. Anderson, AMC commander, the board examined the entire spectrum of program management for existing ballistic missiles, and considered approaches for management of future weapon system programs.

Conclusions of the board, followed by deliberation by Headquarters, USAF, and subsequent announcement by Air Force Secretary Dudley C. Sharp, resulted in separation of ballistic missile development and site activation management responsibilities (AW July 25, p. 35). ARDC remains responsible for the development of the missile weapon system, retains responsibility for site installation design, configuration control and technical engineering, and for technical demonstration of the weapon system operational capability. Previously, command control of the ICBM bases from work inception to point of "turning over the key" to Strategic Air Command was a function of ARDC's Ballistic Missile Division, with AMC's Ballistic Missile Center contributing as a supporting agency. Now, from the point of base beginning—once the site has been selected and announced by ARDC—the readying job is AMC's. This will include such site activation factors as construction, installation and checkout of the system, including communications incorporated into the sites as part of the ground support.

Under this approach, AMC will be responsible for base support to contractors, will negotiate all base support agreements, and will have total responsibility for contractors' direction and performance. The AMC new site commanders will have authorization over all Air Force site personnel regardless of the command to which they are assigned. Associate prime contractors in the Atlas and Titan programs will have technical representatives at the respective sites to assist AMC in its activation job.

Concurrently with the new alignment of site activation responsibility, the U. S. Army's Corps of Engineers has set up a new (reorganized) ballistic missile construction office under Brig. Gen. Alvin C. Welling, in the Air Force's ballistic missile complex in Inglewood, Calif., to expedite site construction. This new office will incorporate the Corps of Engineers present field office in Los Angeles with 30 military and civilian employes. Initial strength of the new construction office will be 25 officers and 125 civilians. Meanwhile, 20 officers from Corps of Engineers have reported to missile sites on temporary duty basis, to be followed shortly by 40 more officers who will be transferred from lower priority assignments to key jobs at missile construction sites.

Contractor Conference

Washington—U. S. Defense Secretary Thomas S. Gates, Jr., called the top officers of 49 companies in the Atlas, Titan and Minuteman programs to Washington late last week in an effort to keep these ballistic missile programs on schedule.

Discussions were to emphasize construction, installation and checkout of equipment. The meeting was one of a series of Defense Department moves to fight the types of program delay which have put Atlas bases as much as five months behind schedule.

Attending the meeting were the top executives of 19 missile system contractors and 30 construction, architectural and engineering contractors. AFL-CIO President George Meany was invited to represent labor organizations.

Ballistic missile program observers feel that this new construction office will have to be delegated specific directive authority, as distinguished from a mere coordinating relationship, with respect to Corps of Engineers' other field offices which have been involved with actual implementation of construction phases of the ICBM sites. If this is not done, these observers contend, a repetition of construction problems encountered in the past will occur. Apparently the question was being given serious consideration at a Corps of Engineers general staff level meeting in Washington last week.

Some ballistic missile program observers have suspected that intra-service friction and rivalry for authority may have been responsible for the switch in site activation responsibility from ARDC to AMC, with the final decision being made in AMC's favor by USAF Headquarters. But observers close to the site management situation declare this is not so—that the change was merely a normal transition, after re-evaluation, of what is considered a basic AMC function. Possibility is that the decision for changeover might have been accelerated by the delay in meeting base work progress schedules, reported to be less than six months late, in the most severe instance, at Offutt AFB, Neb., and less than that at Warren AFB, Wyo. But validity of this deduction is minimized by the fact that ARDC's Ballistic Missile Division still retains responsibility for site activation at these two locations, as well as at Vandenberg AFB, Calif. These are the exceptions to the transfer of site activation authority to AMC.

Site activation management responsibility as originally delegated to ARDC at the start of the ballistic missile program was not considered unusual even in the face of the command's basic research and development role. No comparable experience was available then in this type of construction, with all of the ramifications of critical associated equipment. Certainly no Air Force airfield project had ever involved such work magnitude and complexity. Now that base construction state-of-the-art has moved ahead, along with work on the missile proper, military observers feel that delegation of site activation responsibility to AMC is a natural progression in realignment of duties to utilize most advantageously the talents of both AMC and ARDC. Even before the transfer of responsibility to AMC, base field office operation was staffed by elements from both AMC and BMD, with manpower ratio assigned being about six to one in favor

AMC Site Commanders

The 12 new task force commanders appointed by AMC in its initial step in taking over ICBM site activation responsibility include:

Atlas Sites

Fairchild AFB, Wash.—Col. Thomas S. Jeffrey, Jr.

Walker AFB, N. M.—Col. Robert I. Barrowclough

Forbes AFB, Kan.—Col. William E. Ruark

Schilling AFB, Kan.—Col. Arthur W. Cruickshank

Altus AFB, Okla.—Col. Ernest L. Ramme

Dyess AFB, Tex.—Col. Hugh H. Manson

Plattsburgh AFB, N. Y.—Col. Calvin W. Fite

Titan Sites

Larson AFB, Wash.—Col. Edward J. York

Beale AFB, Calif.—Col. William E. Sault

Ellsworth AFB, S. D.—Col. Kenneth W. Northamer

Mountain Home AFB, Idaho—Col. Harmon E. Burns

Lowry AFB, Colo.—Col. James H. Thompson

of AMC. Types of AMC personnel involved included plant representatives, representatives of the San Bernardino Air Materiel Area (the cognizant AMA), Ballistic Missile Center personnel and others.

Some of the factors which have contributed to the delay in ICBM base progress include:

• **Concurrency concept.** Basic philosophy of developing all elements of the ICBM weapon system concurrently introduces rigid scheduling requirements. When the specific task is defined and held, achievement of concurrency is relatively simple. But when development problems dictate that many factors be varied to keep abreast of an advancing state-of-the-art, concurrency is affected, with introduction of what might be serious delays.

• **Lack of motivation.** Ballistic missile program observers contend that motivation has not been uniformly high "across the board"—that some participants have viewed the ICBM projects with a "business as usual" attitude, contributing to delay.

• **Equipment deficiencies.** Deficiencies in ground support equipment, to be expected in any development program, have appeared. Fast response or retrofit to remedy the condition has not always been available.

• **Tolerances.** New standards of quality control in concrete and steel construction have introduced difficulties in some instances. The exacting tolerances imposed by ICBM weapon system requirements have introduced rigid requirements involving unconventional techniques.

• **Work stoppage.** This has been in excess of the factor allowance originally contemplated in the program. Prime example of another aggravating condition is the steel strike, which lasted over 100 days, and affected equipment delivery as well as construction schedules. Some equipment normally considered in the ground support category actually are construction category items, such as the propellant loading facilities for the missiles, which would be delayed through a shortage of material.

• **Lack of direct control** by Ballistic Missile Division in the construction phases of the base sites. In some instances, BMD did recommend contract terminations to the Corps of Engineers, but no prime contracts were terminated as a result of recommendations.

Navy Asks Evolution Of 2,500 mi. Polaris

Washington—Navy will press advantage gained from recent Polaris successes to push development of the 2,500 mi. A3 missile configuration.

First Polaris submerged launches (AW July 25, p. 32) stimulated favorable comment at both Democratic and Republican conventions, and Navy believes the entire Polaris program will be re-examined during the congressional session this month.

The A1 configuration fired last month has a 1,200 mi. range and will be the first operational version. Navy considers it an interim missile until the second generation, 1,500 mi. range A2 tactical missile is ready early in 1962.

Although the Polaris program is substantially funded now, the Navy feels money should be allotted for concurrent research and development of the A3. Rear Adm. William F. Raborn, Polaris program chief, told the American Rocket Society last week that if A3 were funded now, it would be ready for fleet use in 1964. Raborn said A3 would give Polaris submarines an effective operating area of nine million square miles, triple the area possible with the 1,500 mi. version.

Evolution of Polaris to 1,500 mi. range will result from adding fuel to the first stage engine, which will increase the length of the vehicle from 28 to approximately 31 ft. Longer ranges will come from general miniaturization, materials weight decreases and higher specific impulse in the two solid fuel engines.

Aerojet-General Corp. said it already has successfully tested second generation motors and plans flight tests later this year. Aerojet said the A1 configuration releases total energy of more than five million pound/seconds.

Since the submarine Polaris launches, the Navy has awarded contracts totaling $120.5 million for program components. Electric Boat Division of General Dynamics Corp. won a $60.1 million contract to build two fleet ballistic missile submarines, and Newport News Shipbuilding and Dry Dock Co. was given a $32.4 million contract for one submarine. Northrop Nortronics Division was awarded $28 million contract for DATICO checkout system (AW July 25, p. 86), gyroscopes, periscopes and radiometric sextants.

As the missile system nears operational status, North Atlantic Treaty Organization nations are continuing consideration of the U. S. proposal that they accept Polaris as a medium range missile.

Present British sentiment is against arming Germany with an offensive nuclear weapon, but British support for over-all NATO-Polaris program is expected if U. S. backs the British nuclear submarine program.

French reaction apparently is cool because President Charles de Gaulle prefers to maintain in France the technical capabilities to develop complete weapons systems. France has established a $2.3 billion, four-year program to develop nuclear weapons and delivery systems (AW July 25, p. 34).

Titan II Propellant System Briefing Set

Air Force Ballistic Missile Division will hold a briefing for suppliers Aug. 9 in Inglewood, Calif., on a new prequalification program for components of the Titan II propellant transfer system.

As defined by BMD, the Titan II propellant transfer system consists of mobile loading and unloading equipment, propellant umbilicals that connect to the missile, and piping that will connect the mobile equipment to the umbilicals.

The system will be designed to handle the new storable propellant—a mixture of hydrazine and unsymmetrical dimethyl hydrazine fuels and nitrogen tetroxide oxidizer—that will be used in the Titan II.

Air Force will subject all critical propellant transfer system components to prequalification tests. At the moment, work is still under way on identifying the critical components in the following categories: valves, filters and strainers, pumps and meters, load cell platforms, and instrumentation.

On Aug. 9 the Air Force will list these components for potential suppliers.

Republicans Pledge New Defense Efforts

By Ford Eastman

Chicago—Republicans stiffened their defense platform at the urging of New York Governor Nelson A. Rockefeller during the national convention here last week, pledging new defense efforts but electing to stand on their record and continue Administration policies in science and technology and transportation.

This is how the GOP stands in these areas:

• **National Defense**—In the revised national defense plank, the GOP recognized the swift technological changes taking place and pledged "intensified and courageous" defense efforts and promised to provide any necessary increased expenditures to meet new situations.

• **Science and Technology**—Despite admissions that Russia leads the U. S. in big boosters, the Republican platform said that in over-all science and technology, the U. S. has, is and will continue to lead the world. At the same time, however, the Republicans pointed out the need for strong basic and applied research programs and promised continued government support in projects of national significance.

• **Transportation System**—In the only reference to transportation, Republicans pledged "continued improvement of our vital transportation network, carrying forward rapidly the vast Eisenhower-Nixon national highway program and promoting safe, efficient, competitive and integrated transport by air, road, rail and water under equitable, impartial and minimal regulation directed to those ends."

Defense Plank

In the platform conclusions, written after the defense plank had been revised, Republicans said "we believe that we see, so far as men can see through the obscurity of time and trouble, the prudent course for the nation in its hour of trial.

"Soviet Union has created another of the new situations of peril," the platform said, "which has been the Communist record from the beginning and will continue to be until our strategy for victory has succeeded.

"The speed of technological change makes it imperative that we measure the new situations by their special requirements and accelerate as appropriate our efforts in every direction, economic and military and political to deal with them.

"As rapidly as we perfect the new generations of weapons," the platform said, "we must arm ourselves effectively and without delay. In this respect the nation stands now at one of the new points of departure. We must never allow our technology, particularly in nuclear and propulsion fields, to lag for any reason until such time as we have dependable and honest safeguards of inspection and control."

The defense platform, which in a large part follows the Rockefeller-Nixon agreement reached in New York earlier, said that under the Eisenhower-Nixon Administration, the nation's military strength has been "forged into a power second to none," and pledged the U. S. will continue to have the defenses needed to protect freedom.

In the revised platform this language was added: "Swift technological change and the warning signs of Soviet aggressiveness make it clear that intensified and courageous efforts are necessary, for the new problems of the 1960s will of course demand new efforts on the part of our entire nation."

'No Price Ceiling'

The Republican platform said "there is no price ceiling on America's security. The United States can and must provide whatever is necessary to ensure its own security and that of the free world, and (this was added in the revide whatever is necessary to ensure increased expenditures to meet new situations.'"

Strategic imperatives of the national defense program, Republicans said, are these:

• "**A second-strike capability**, that is, a nuclear retaliatory power that can survive surprise attack, strike back, and destroy any possible enemy.

• "**Highly mobile and versatile forces**, including forces deployed, to deter or check local aggressions and 'brush fire wars' which might bring on all-out nuclear war.

• "**National determination** to employ all necessary military capabilities so as to render any level of aggression unprofitable. Deterrence of war since Korea, specifically, has been the result of our firm statement that we will never again permit a potential aggressor to set the ground rules for his aggression; that we will respond to aggression with the full means and weapons best suited to the situation."

Maintenance of these imperatives requires the following actions, the GOP platform stated:

• "**Unremitting modernization** of our

VTOL Research Reoriented

Washington—Military development efforts to produce operational VTOL aircraft are being channeled into the immediate single objective of building a large vertical rising transport which can be used by all of the services to study and define their detailed engineering and field requirements for this class of aircraft.

This development aircraft will precede any design slated for quantity production. Low priority has been assigned to the development of VTOL aircraft during the next few years, and consolidation of effort among the services is being sought by Dr. Herbert York, director of defense research and engineering, to make the best use of available funds.

An ad hoc committee at the assistant service secretary level has been formed to obtain agreement from technical authorities in the Army, Navy and Air Force on the basic type of VTOL system which should be used for their jointly sponsored aircraft. This committee is operating in close coordination with a permanent tri-service committee at Department of Defense level that is headed by Cal Muse. This committee has been responsible since February for coordinating VTOL development within DOD after reviewing and evaluating the technical merits of past programs carried on by the services. A decision regarding the award of a contract to build the large VTOL transport testbed will be made by agreement between both committees. Current Pentagon estimates of the length of time required for this decision range from two to six months. The money for the contract will come from Fiscal 1961 funds.

Most of the VTOL concepts which have been flight tested are receiving technical consideration for the multi-service VTOL development transport. These include the tilt-wing and deflected slipstream types. The unloaded rotor system, however, has the greatest support at present. This concept was pioneered in the U. S. with the McDonnell XV-1 and on the Fairey Rotodyne in England. Rotors which provide lift during the takeoff and descent of these vehicles are driven by hot gas exhausted at their tips. During cruise, the hot gas to the rotors is stopped, and they are unloaded and turn like an autogyro rotor. Horizontal thrust for cruise can be provided by propellers or jets. Development of unloaded rotor aircraft has been suspended for several years in the U. S.

retaliatory forces, continued development of the manned bomber well into the missile age, with necessary numbers of these bombers protected through dispersal and airborne alert.

• **"Development and production** of new strategic weapons (and the following was added to the revised draft) 'such as the Polaris submarine and ballistic missile. Never will they be neglected' as intercontinental missile development was neglected between the end of World War II and 1953.

• **"Accelerate as necessary,** development of hardening, mobility, dispersal and production programs for long-range missiles and the speedy perfection of new and advanced generations of missiles and anti-missile missiles." (The phrasing 'accelerate as necessary' and 'and production' were added to the revised draft.)

• **"Intensified development** of active civil defense to enable our people to protect themselves against the deadly hazards of atomic attack, particularly fallout; and to develop a new program to build a reserve of storable food, adequate to the needs of the population after an atomic attack.

• **"Constant intelligence** operations regarding Communist military preparations, to prevent another Pearl Harbor.

• **"A military establishment** organized in accord with a national strategy which enables the unified commands in Europe, the Pacific and this continent to continue to respond promptly to any kind of aggression.

• **"Strengthening of the military** might of the free-world nations in such ways as to encourage them to assume increasing responsibility for regional security.

• **"Continuation of the 'long-pull'** preparedness policies which, as inaugurated under the Eisenhower-Nixon Administration, have avoided the perilous peaks and slumps of defense spending and planning which marked earlier Administrations."

New York Meeting

After the New York meeting between Governor Rockefeller and Vice President Nixon before the convention started, the two agreed that in national defense, "the swiftness of the technological revolution—and the warning signs of Soviet aggressiveness—makes clear that new efforts are necessary, for the facts of survival in the 1950s give no assurance of such survival, in the same military posture, in the 1960s."

They agreed that two imperatives of national security in the 1960s are a "powerful second-strike capacity—a nuclear retaliatory power capable of surviving surprise attack to inflict devastating punishment on any aggressor, and a modern, flexible and balanced military establishment with forces capable of deterring or meeting any local aggression."

These inperatives require, they said, more and improved bombers, airborne alert, speeded production of missiles and Polaris submarines, accelerated dispersal and hardening of bases, full modernization of the equipment of ground forces and an intensified program for civil defense.

The science and technology platform subcommittee, headed by Sen. Gordon Allott (R.-Colo.), said "reliable evidence indicates, all areas of scientific knowledge considered, that our country has been, is, and, under our system of free inquiry, will continue to be the greatest arsenal and reservoir of effective scientific knowledge in the world."

The platform closely followed the recommendation of Dr. Lee A. DuBridge, president of the California Institute of Technology, who testified earlier during the committee hearings.

Dr. DuBridge called for government encouragement of basic science, encouragement of those activities in applied science which are pertinent to problems of national concern such as atomic energy, space exploration and national defense, and strengthening of government agencies involved in such activities.

The federal role in research, the platform suggested, should be in the area of basic research which industry cannot be reasonably expected to pursue, and applied research in fields of prime national concern such as national defense and exploration and use of space.

The platform added that it endorsed contracting by government agencies for research, and at the same time, urged allowance for reasonable charges for overhead and management in the contracts.

Foreign Policy

In the foreign policy platform, Republicans said:

• **"We believe military assistance** to our allies under the mutual security program should be continued with all the vigor and funds needed to maintain the strength of our alliances at levels essential to our common safety. The firm diplomacy of the Eisenhower-Nixon Administration has been supported by a military power superior to any in the history of our nation or in the world. As long as world tensions menace us with war, we are resolved to maintain an armed power exceeded by no other.

• **"Under the United Nations** we will work for the peaceful settlement of international disputes, and the extension of the rule of law in the world. And, in furtherance of President Eisenhower's proposals for the peaceful use of space, we suggest that the United Nations take the initiative to develop a body of law applicable to the peaceful use of space.

• **"We are ready to negotiate** and to institute realistic methods and safeguards for disarmament, and for the suspension of nuclear tests. We advocate an early agreement by all nations to forego nuclear tests in the atmosphere, and the suspension of other tests as verification techniques permit."

In the revised foreign policy plank, these words were added: "We support the President in any decision he may make to re-evaluate the question of resumption of underground nuclear explosions testing if the Geneva Conference fails to produce a satisfactory agreement."

Under economic growth and business, the GOP platform said employment must be raised to higher levels and efforts must be made to utilize even more fully the expanding over-all capacity to produce.

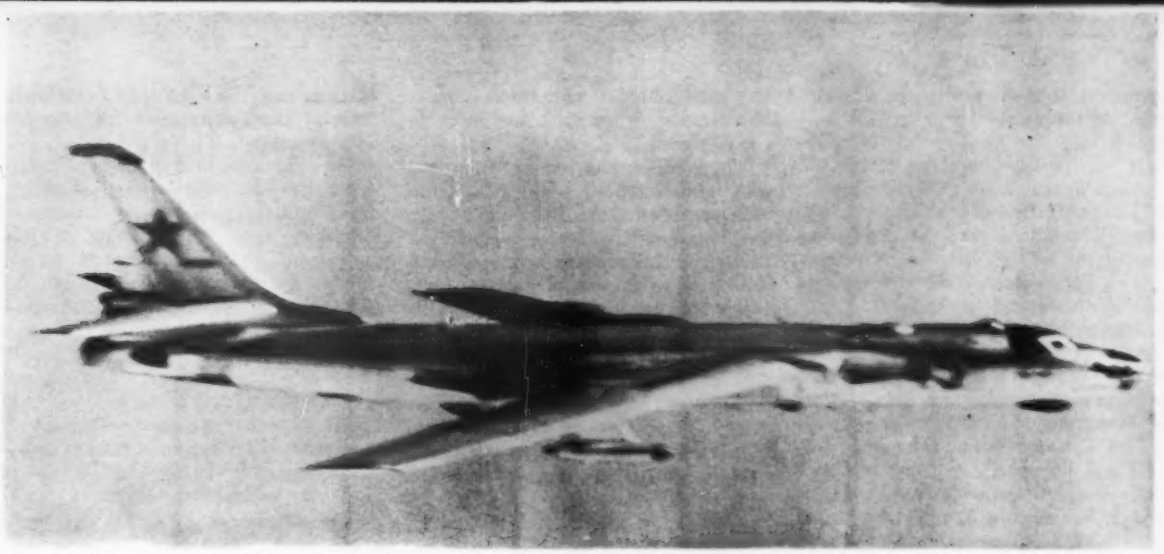
The platform committee said it accorded a high priority to vigorous economic growth and recognized that its mainspring lies in the private sector of the economy. "We reject," the committee said, "the concept of artificial growth forced by massive new federal spending and loose money policies." The committee added that the only effective way to accelerate economic growth is to increase the "traditional strengths of a free economy—initiative and investment, productivity and efficiency."

The platform recommended, under government administration, that two top positions be established to help the President in the entire field of national security and international affairs, and in governmental planning and management.

The platform also said: "We must undertake further reorganization of the Defense Department to achieve the most effective unification of defense planning and command, and improved conflict of interest laws should be enacted for vigilant protection of the public interest and to remove deterrents to governmental service by our most able citizens."

Thomas Leaves TWA

New York—Charles S. Thomas resigned as president, chief executive officer and a director of Trans World Airlines last week. Thomas, who had just completed two years as TWA president, said he resigned at the end of his two year contract to "return to his family and other interests in California." In accepting his resignation the TWA board of directors said there was no immediate successor under consideration.



SOVIET TU-16 Badger was photographed by USAF over the North Pacific. Note pod under wing for electronic reconnaissance equipment.

Soviet Veto Stops RB-47 Investigation

By David H. Hoffman

New York—A Soviet veto in the U. N. Security Council last week scuttled a U. S. resolution urging an impartial investigation of whether the USAF RB-47 shot down by the Russians on July 1 had actually penetrated Soviet airspace.

The Russian rejection of the proposal followed U. S. Ambassador Henry Cabot Lodge's revelation that Soviet Air Force Tu-16 bombers regularly were flying electronic reconnaissance missions along Alaska's western perimeter and had been "for years."

One such flight, Lodge said, penetrated U. S. airspace 5 naut. mi. off St. Matthew Island in the Bering Sea. The aircraft presumably was a ferret mission to probe Alaska's early warning radar defenses.

In the same session of the Security Council here, the Soviet Union vetoed an Italian resolution that would have enabled the International Red Cross to make contact with two of the downed RB-47 crewmen now being held by the Russians on charges of espionage.

Nine of the 11 nations represented on the Council favored the two resolutions. Only Poland sided with the USSR as it cast its 88th and 89th vetoes last Tuesday night.

Earlier, the same nine states voted down a Soviet resolution that sought to "condemn" the RB-47 flight as an "aggressive act," while "insisting" that the United States call a halt to electronic reconnaissance missions.

During the three-day debate here, Lodge contended that the RB-47 was forced by a Soviet fighter to fly onward through the Barents Sea along a course aimed at Russia's Kanin Peninsula.

Pressing in from the Arctic Ocean to the north, the fighter delayed the bomber's intended turn away from the coastline—a turn scheduled to take place 50 naut. mi. from the nearest Soviet territory, Lodge said. The fighter's tactics, apparently monitored by both the United States and Great Britain from the powerful NATO radar station at Varda, Norway, brought the RB-47 to a point 30 mi. off the tip of the Kanin Peninsula.

"This is the closest it ever was to the territory of the Soviet Union," Lodge declared.

Russia had contended that the reconnaissance bomber was shot down 13.67 mi. north of Svyatoy Nos Cape at 1503 Greenwich time while flying toward the city of Archangel. But Lodge maintained that the plane disappeared at 1522 GMT, some 209 mi. from Svyatoy Nos while flying in the opposite direction.

According to Lodge, the RB-47 was heavily instrumented with navigation radar that enabled a constant cross-check of its position with respect to the Russian coast. Moreover, the crewmen were to "make a special check to assure themselves that the radar was functioning properly" before overflying an imaginary line 75 mi. out from Russian territory, Lodge said.

These precautions, Lodge told the Council, were taken because the crew knew that "the Soviet Union had in the

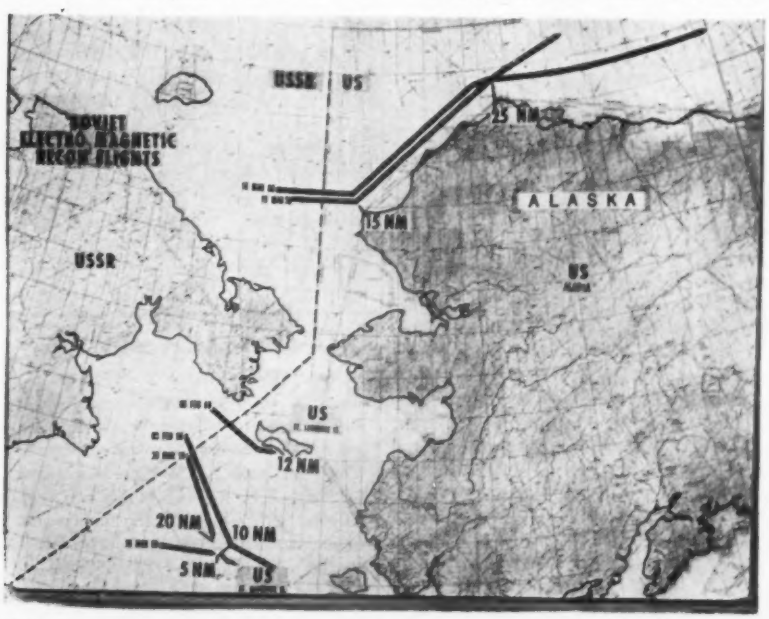
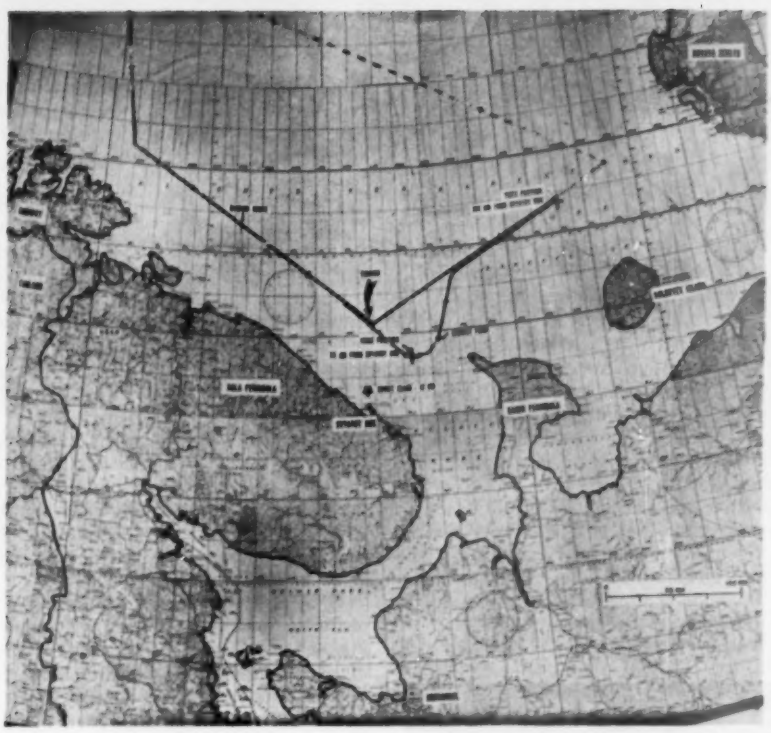


CHART plots courses of six Soviet ferret flights that approached Alaskan coast during 1959 and 1960. Three missions converged on St. Matthew Island, north of the Aleutian chain.



SOLID BLACK line of Barents Sea map shows track of RB-47. First X marks spot where Soviets claim plane was downed. Second X indicates coordinates where plane disappeared from U. S. radar scopes, while looped line to the south follows RB-47 detour forced by Russian fighter. Dashed line projects plane's intended course.

past lured planes towards its frontier" (AW July 18, p. 30).

Contrasting the RB-47 flight with comparable Soviet flights off Alaska, Lodge cited six specific instances in which Russian reconnaissance bombers had approached the U. S. coast at distances of less than 30 mi. Lodge made it clear that the Soviets were probing the northeastern air approaches to the United States from Pt. Barrow—Alaska's northerly extreme where one of the six DEW Line main stations is located—to St. Matthew Island—about 750 mi. west of Anchorage.

On a large chart, one of five illustrations Lodge displayed before the Security Council, the delegate traced the course of the Soviet trawler Vega, which collected electronic data along the United States' eastern seaboard last April and May.

On Apr. 26, Lodge said, the Vega made its first appearance about 105 mi. southeast of Cape Cod, Mass., cruising an area in which the U. S. nuclear submarine George Washington was testing the Polaris missile ejection system. Disregarding instructions from U. S. naval vessels to stand clear, the Vega, according to Lodge, actually attempted to retrieve a "loaded test vehicle" discharged earlier by the George Washington. The dummy missile was recovered by the USS Nimpuc, a support ship, only after sharp maneuvering had averted a collision with the Vega, Lodge said.

Countering that the presentation of maps was a theatrical maneuver, Vasily V. Kuznetsov, a first deputy foreign minister of the Soviet Union, aimed these two questions at Lodge:

Why, if the United States was aware of the precise point at which the RB-47 disappeared, was the subsequent search not begun there? And why, if the plane was on a scientific mission, was it instructed to maintain radio silence?

The four-power bloc of small nations represented on the Council—Ecuador, Ceylon, Argentina and Tunisia—generally refrained from accepting at face value either the U. S. or Soviet version of the RB-47 incident. Many observers here felt that these four nonpermanent members of the Council had been swayed from siding directly with the United States by its handling of the U-2 incident last May.

Two of the four, Ceylon and Argentina, recommended the cessation of close-proximity reconnaissance flights, even when such flights remained over international waters, as a means of lessening international tension. All, including the United Kingdom, France, Italy and Nationalist China, agreed that the burden of proving whether the RB-47 flight actually was an "aggressive act," fell upon the Soviet Union and that the Soviet Union had failed "to make its case."

Sir Pierson Dixon, delegate from the United Kingdom, asserted that Soviet trawlers equipped to intercept radio transmissions and "numerous unidentified submarines" frequently sailed close to British territorial waters, especially when naval exercises or military research projects were in progress. Were an issue made of each instance "we were overlooked or overheard" by the USSR, he said, the Security Council would have to be in "virtually permanent session."

Soviet Charge Denied

Washington—U. S. has rejected the Soviet Union's charge that buzzing of Russian ships in international waters by U. S. aircraft creates danger to life and violates freedom of passage and international law.

Russia's statement that it will "take other measures" if the buzzing continues (AW July 25, p. 33) is "a reckless threat" that resembles other recent Soviet statements and actions, the State Department said. State said U. S. aircraft are under strictest instruction to approach no closer than necessary, but that identification is sometimes necessary —as in the case of the Soviet electronic ferret ship Vega, which ostensibly was a fishing trawler.

In an indirect reference to Russia's shooting down of a USAF RB-47 last July 1 (see p. 30), the U. S. said it notes with interest Russia's concern over freedom of the seas and hopes Russia "might now begin to respect this freedom on the part of other nations, whether for ships or aircraft."

Cessna Is Building 'Different' Light Twin

Wichita, Kan.—A four-place light twin-engine business plane of "completely different design" is being built here by Cessna Aircraft Co., which expects to put the new model on the market in 1962. First flight of the prototype is expected early next year.

The company refuses to discuss details of configuration or performance of the new design, but indications are that it is planned to be directly competitive with the Piper Apache in price.

Del Roskam, vice president-Aircraft Divisions, says that the new Cessna will represent "a basic new approach to twin-engine aircraft philosophy and will set a new pattern of thinking and engineering to meet the challenge of changing times and needs," which emphasizes that company designers have decided to break away from the conventional low-wing two-engine formula to get maximum performance and sales potential. Roskam indicated that the airplane will outperform anything in its class.

NATO Hawk Missile Program Calls for Early Fall Production

Paris—NATO's Hawk missile program, in which five West European nations plan to spend nearly $500 million of their own defense funds in producing the U.S. Army-Raytheon air defense missile, should enter the production stage early this fall.

Five-nation agreement was reached last June by Belgium, France, West Germany, Italy and The Netherlands (AW June 24, 1959, p. 24). Since that time the five nations have been ironing out a maze of technical, legal and industrial problems before translating their agreement into a full-scale production program.

In particular, there has been sharp discussion over license fees between the European nations involved and Raytheon, U.S. prime contractor for the Hawk. These differences, somewhat exaggerated by a few European officials involved, are considered by the U.S. Defense Department as "normal to the U.S. scene." At any rate, the problem was settled last Apr. 13 when a license agreement finally was signed between Raytheon and the European nations.

Delays in implementing the Hawk program were expected. Project marks the first major success of a U.S. policy established at the 1957 NATO summit conference. At that session, President Eisenhower promised NATO nations the U.S. would help to establish in Western Europe large-scale production of advanced type weapons.

The Hawk program is regarded as a precedent for future joint efforts within NATO. Thus all interested parties have been seeking to negotiate the best arrangement possible. This, obviously, has wasted time.

It is still possible, though, that initial Hawk deliveries to the European nations involved will be made as planned by June, 1961. This could happen since initial units probably will be assembled mainly from components made in the U.S. Initial deliveries of European-made Hawks should begin rolling off the line by late 1961. The program is expected to run until 1964.

As currently planned, the program involves 22 Hawk battalions. Based on probable cost of $20 million per battalion, the total program should amount to at least $440 million. U.S. funds for the 22-battalion program are expected to be under $40 million.

U.S. also will supply the necessary technical information, including drawings, specifications and sample equipment. Raytheon and Hawk subcontractors such as Aerojet-General Corp. and Northrop Corp. will work with European companies involved. Details on license arrangement between the American and European interests have not been released.

A breakdown of national involvement in the program has never been released. But it is known that West Germany will get nine battalions; Italy, four and France, Belgium and Holland, three each. Originally, France was as heavily involved in the program as West Germany, but later reduced its commitment to three battalions.

With most of the preliminary negotiations now out of the way, it is easier to see how the NATO Hawk production program will be run. In a Paris suburb a NATO Hawk management office has been set up under retired Dutch air force Lt. Gen. W. J. Reynierse. Gen. Reynierse is the real "customer" for the European Hawks. He, in effect, is seeing that the Hawk missiles required by the five interested nations get built when and how they should be. It is Gen. Reynierse who, in late August or early September, will place production orders for the 22 Hawk battalions with groups of European companies formed for this job.

This combine, headquartered in Paris, is called Societe Europeanne de Teleguidage (STEL). STEL is the prime European contractor for Hawk and as such was involved with Raytheon in negotiating manufacturing rights and license fees. Each of the five nations involved are represented in STEL by a prime national contractor. These are: Ateliers de Construction Electrique de Charleroi, Belgium; Telefunken, Essen, West Germany; Finmeccanica, Italy; Philips, Holland; and Thomson-Houston, France.

Subroc ASW Missile Under Navy Development

Subroc guided missile, under development by the U. S. Navy for anti-submarine warfare, is fired from submerged torpedo tube, programed through the air, and re-enters the water for submarine kill. It has far greater range than present ASW torpedoes.

USAF's Congo Airlift Structure Extends Almost 11,000 Naut. Mi.

Wiesbaden—United States Air Force transport of troops and supplies into the stricken Congo Republic for United Nations has fanned into USAF's longest airlift in history in terms of total route miles, according to officials here.

Statistics at Wiesbaden headquarters, U. S. Air Force in Europe, show that by late last week, as 17 Lockheed C-130 turboprop transports of the 322nd Air Division began loading 678 Irish troops at Dublin, the Air Force's airlift route mile structure had grown to almost 11,000 naut. mi.

Air Force by last week had transported approximately 5,177 troops of five nationalities over these routes since the military airlift got into full swing at United Nations' request on July 16. It hopes to land over 4,000 more, including troops of three new nationalities, before end of the week.

Here are the major route structures being used by the 40 C-130s and 60 Military Air Transport Service Douglas C-124 airlift aircraft:

• **Dublin to Evereux, France**, 360 naut. mi.; Evereux to Wheelus AFB, Libya, 1,100 naut. mi. or, on another schedule, Cairo to Wheelus, 900 naut. mi.; Wheelus to Kano, Nigeria, 1,400 naut. mi.; Kano to Leopoldville, 1,100 naut. mi.

• **Chateauroux, France**, home base for the MATS C-124s, to Strategic Air Command base at Sidi Slimane in Morocco, 1,000 naut. mi.; Sidi Slimane to Dakar, 1,400 naut. mi.; Dakar to Accra, Ghana, 1,000 naut. mi.; Accra to Leopoldville, 1,100 naut. mi.

• **Addis Ababa, Ethiopia**, with Ethiopian troops, to Stanleyville, Congo, 1,000 naut. mi.; Stanleyville to Leopoldville, 600 naut. mi.

Round-trip C-130 flight between Evereux and Leopoldville via Dakar requires an average of 33 hr. to complete the trip. A C-124 operating from Chateauroux to Leopoldville, also via Dakar, normally needs approximately 55 hr. for the round trip.

Troops airlifted by Air Force transports and already on station in the Congo include contingents from Ghana, Guinea, Morocco, Tunisia and Sweden. The 745 Swedish troops had been assigned to the U. N. security force in the Gaza Strip between Egypt and Israel and were transported to the Congo from Cairo.

USAF airlifts under way last week, and scheduled to continue into this week, included:

• **Ethiopia**, 1,340 troops and 100 tons of equipment with 11 C-130s.

• **Morocco**, another contingent of 1,250 troops and 81 tons of equipment with 20 C-124s.

• **Guinea**, new contingent of 600 troops and 25 tons of equipment.

• **Liberia**, 250 troops and 10 tons of equipment in four C-130s.

• **Ireland**, 678 troops and 80 tons of equipment.

USAF also may be called upon to provide airlift for troops from the Sudan and at least one more African nation.

In return flights to Europe from the Congo, U. S. Air Force aircraft also have ferried out over 2,500 refugees, including more than 300 U. S. citizens. Evacuees have been landed at Evereux and Chateauroux Air Force Bases and at Rhine-Main Air Base in Germany as well as at Brussels, home base for the major Sabena Belgian World Airlines evacuation effort.

Air Force also has turned over to the U. N. command 10 C-47 support aircraft for use within the Congo (AW July 25, p. 37) and is making available five Fairchild C-119s that have been painted white with U. N. markings. U. S. Army is supplying the U. N. with six light liaison aircraft and 10 helicopters for use within the Congo.

The United States, however, in a determined effort to keep hands off internal Congo affairs, will not provide flight and maintenance crews for these aircraft.

The planes and helicopters will be flown and maintained by crews from such countries as Brazil, Argentina, Sweden and probably Norway.

USAF also has airlifted rations into the Congo for use by U. N. troops and civilians and plans to funnel in more until an effective sea lift can be organized.

Douglas Wins Contract For Missileer Design

Washington—Navy has chosen Douglas Aircraft Co. to design and develop the subsonic Missileer aircraft as a launch platform for the long-range Bendix Eagle air-to-air missile.

Eagle-Missileer program will cost $3.4 billion over a 10-year development and production cycle, Navy said. Initial Douglas contract is for Missileer design, and the Navy soon will negotiate a development contract for the aircraft.

Carrier-based Missileer will weigh 50,000 lb. and have an endurance on station of four to six hours. Speed will be approximately Mach 0.9. Eagle missile, under development 19 months, has a range of about 50 mi.

Missileer will be powered by two Pratt & Whitney TF30-P-2 turbofan engines. Characteristics are similar to the Pratt & Whitney JTF-10, which weighs 2,110 lb. and has a thrust of 8,250 lb. (AW Sept. 28, p. 49).

Douglas contract commits the Navy to a new air defense concept employing a high performance missile launched from a low performance aircraft. Alternative would be a Mach 2 or 3 aircraft carrying a missile with a shorter range than the Eagle.

Six airframe manufacturers submitted proposals containing one or both alternatives (AW Mar. 21, p. 23). Navy chose the new aircraft for these reasons:

• **Existing aircraft** do not have endurance, or cycle time, to meet long range operational requirements. Turbofan engine has low specific fuel consumption and long range.

• **Missileer-Eagle system** will be called on for two missions for which a single weapons system is not in existence. System will be used for fleet air defense and will be on constant air alert. It also will cover Marine landing forces in the period before anti-aircraft defenses are set up ashore.

Adm. J. T. Hayward, deputy chief of naval operations (development), said the Navy had considered the Douglas A3D, Grumman W2F, North American A3J Vigilante and F-108 as Eagle launchers, then asked industry to "look at any present aircraft versus a new aircraft."

Two-stage solid propellant Eagle will use active homing radar guidance being developed by Bendix. Aerojet-General is motor contractor, and Grumman manufactures the airframe.

IAM Representation Vote Asked by P&W

Pratt & Whitney Division of United Aircraft Corp. last week filed a decertification petition with the National Labor Relations Board requesting an election to determine how many P&W employes the striking International Assn. of Machinists represents.

Pratt & Whitney said 80% of its production employes were reporting to work last week at plants in East Hartford and Manchester, Conn., although these facilities have been struck for more than seven weeks (AW June 13, p. 31).

Workers voted on July 23 to reject a P&W offer, and early resumption of negotiations appeared remote last week. Talks at Hamilton Standard in Windsor Locks, Conn., are continuing between IAM and United Aircraft negotiators. Settlement between Sikorsky Division of United Aircraft and the United Auto Workers remains stalemated (AW July 25, p. 34).

NASA Plans Three-Man Spacecraft

Washington—System design study contracts for Project Apollo, a 3-man modular spacecraft that will be the follow-on to the Mercury manned capsule, will be awarded in the near future, National Aeronautics and Space Administration said last week in briefing some 1,300 industry representatives on its plans for the next 10 years.

Systems contract for design, engineering and fabrication of Apollo and its components probably will be initiated in Fiscal 1962, NASA said. The vehicle would consist of a command center module, a propulsion module and a mission module. It would serve first as an earth-orbiting laboratory and later for manned circumlunar flight.

Research and development and prototype flights are expected to begin in 1962 and end in 1965. Early tests would use the Atlas-Agena B vehicle. Full-scale spacecraft will require use of the Saturn and could be flown in 1966.

NASA also told industry it plans 96 scientific satellite launchings, 33 lunar and planetary missions, 41 launchings related to manned flight, 28 launchings for satellite applications such as communications, and 62 launchings for vehicle development over the next 10 years.

Placing heavy emphasis on the degree to which it will rely on industry for help and keep in-house development to a minimum, NASA told industry of these proposed projects, most of which already have approval:

- Aeros. Meteorological satellite to be placed into 23,000 mi. "stationary" orbits by the Centaur vehicle. Not approved yet but may be initiated in Calendar 1962 with first launching in 1964. Contractor for the Nimbus meteorological satellite (see p. 23) system integration and basic structure work will be picked early this fall.
- Ranger, Surveyor and Prospector. Ranger will be a lunar impacter launched by Atlas-Agena B, Surveyor will be a lunar soft-lander launched by Centaur and landing 100-300 lb. on the moon, and Prospector will be launched by Saturn to land a mobile laboratory on the moon that would have a traveling radius of some 50 mi.
- Mariner. Early planetary probes to Mars and Venus, weighing 600-1,200 lb. and launched by Atlas-Agena B. First one may be flown in 1962.
- Voyager. Later series of planetary probes, launched by Saturn to orbit Mars and Venus and probably eject instrumented capsules for atmospheric entry and perhaps landing.
- Rebound. Network of passive communications reflectors, a follow-on to Echo experiments. Langley Research Center now is evaluating bids for studies of ways to make large reflecting surfaces rigid. If studies are successful, they may lead to launching of such a structure in 1962. Rebound would follow, probably would require 12 satellites spaced around the world to provide continuous communication and would require that several satellites be placed in orbit by a single vehicle. Rebound may use the Atlas-Agena B for launches in the 1963-1965 period.

Apollo is expected to be able to support life for a period ranging from two weeks to two months as an earth-orbiting laboratory, or about a week for the circumlunar mission. Mission capsules would be changeable to suit the mission. Crew of three is tentative, as are many aspects of the program. Most aspects will be influenced heavily by the outcome of Mercury flights.

NASA's research and space flight centers were given very detailed program guidelines for Apollo several months ago and are engaged now in intensive research and study programs. This information will be made available to industry—partly through a series of briefings at the centers that are to be an extension of the major conference held at headquarters here last week.

NASA Administrator T. Keith Glennan said industry will carry an increasing proportion of NASA's workload, including more systems engineering and project management. He estimated that more than 75% of the expected $1.5 billion-a-year NASA budget will be spent in contracts. No new major NASA installations are planned, Glennan said.

News Digest

Silo deployment type Atlas E models have been redesignated as a new series—the Atlas F. First test deployment is at least a year away at Vandenberg AFB, Calif.

General Electric will develop new ablative re-entry vehicle at its Philadelphia plant for the Mark VI re-entry vehicle for the Titan II under contract to be awarded by USAF.

Ten Strategic Air Command generals are rotating tours of duty in SAC's Boeing KC-135 airborne command post during twice-weekly practice missions.

Martin Co. has named Holmes M. Brown to the new post of corporate director of communications. Joseph M. Rowland will continue to be corporate director of information services and advertising under Brown's over-all supervision. Brown recently resigned as public relations manager for Ford Motor Co.'s Ford Division.

Dr. John F. Victory, first employe of the National Advisory Committee for Aeronautics, has retired after 45 years with NACA and its successor the National Aeronautics and Space Administration and almost 52 years of continuous government service. Victory, 68, held various NACA posts and was executive secretary when it was absorbed by the space agency in October, 1958. Since then, he has been special assistant to NASA Administrator T. Keith Glennan.

Chicago Helicopter Airways Sikorsky S-58C crashed in a cemetery about half way between Midway Airport and O'Hare Airport last week, killing the 11 passengers and two crewmen aboard.

McDonnell Aircraft Corp. has applied to the Civil Aeronautics Board for a certificate as a supplemental airline in both domestic and overseas operations. McDonnell said it would operate the service with DC-3s, Aero Commanders and "such other types of aircraft as may be appropriate."

Hiller Aircraft Corp., Palo Alto, Calif., and Electric Autolite Co., Toledo, Ohio, are negotiating merger of the two companies.

United-Capital Merger

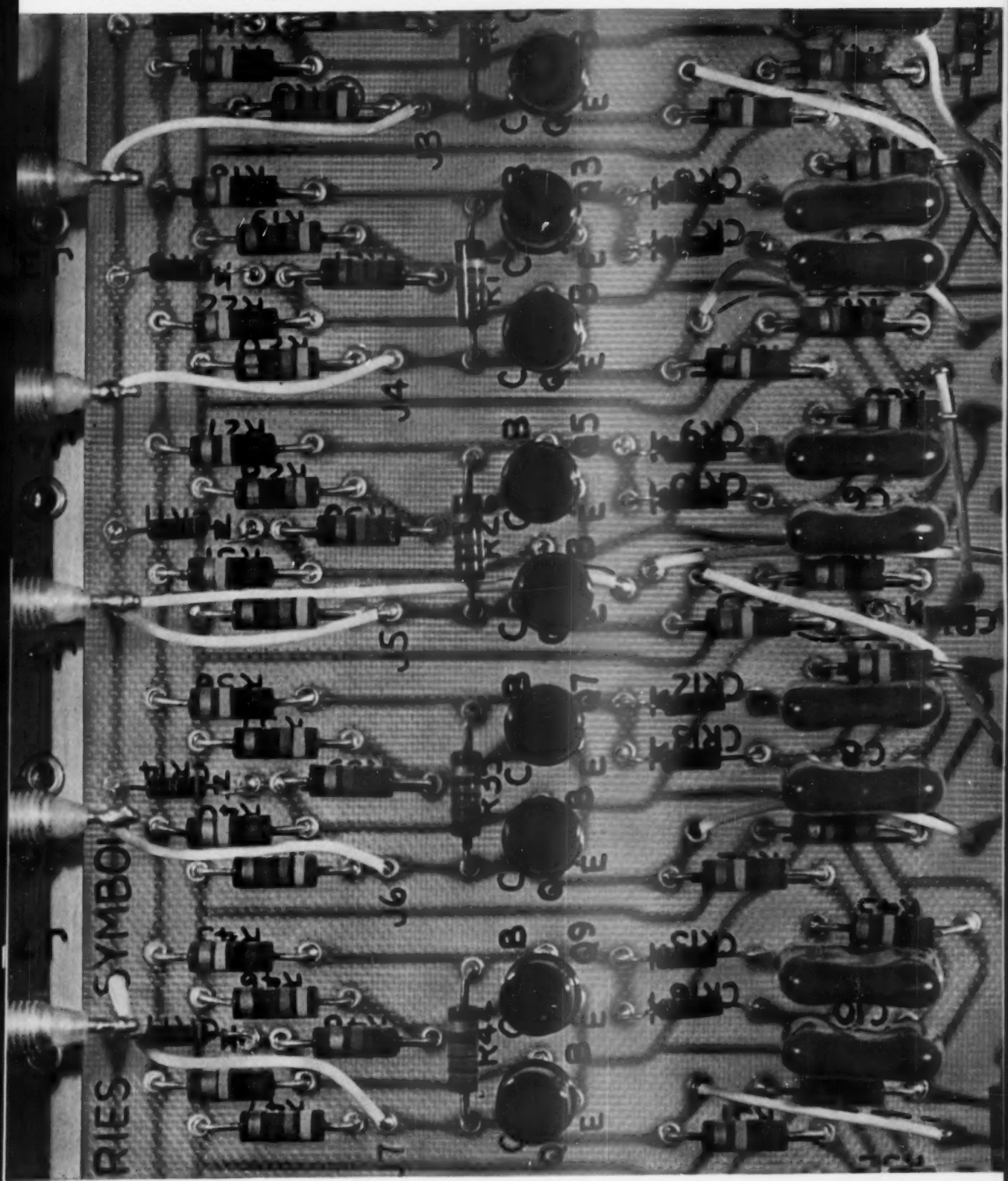
Washington—United Air Lines plans to take over Capital Airlines under a merger agreement reached here last week.

The two airlines agreed to merge under terms which would give United common stock to Capital shareholders and bondholders and would give Vickers-Armstrongs United preferred and common stock plus 15 Viscounts to settle the British company's claims on Capital. Vickers will support the merger, which must be approved by stockholders of the two airlines and by the CAB.

Under the agreement, Capital stockholders will get one share of United common, plus a five year warrant to buy 1.5 shares of United stock at $40 a share for each seven shares of Capital stock held. Holders of Capital's 4.25% convertible subordinated debentures will be offered 20 shares of United stock for each $1,000 par value of debentures held.

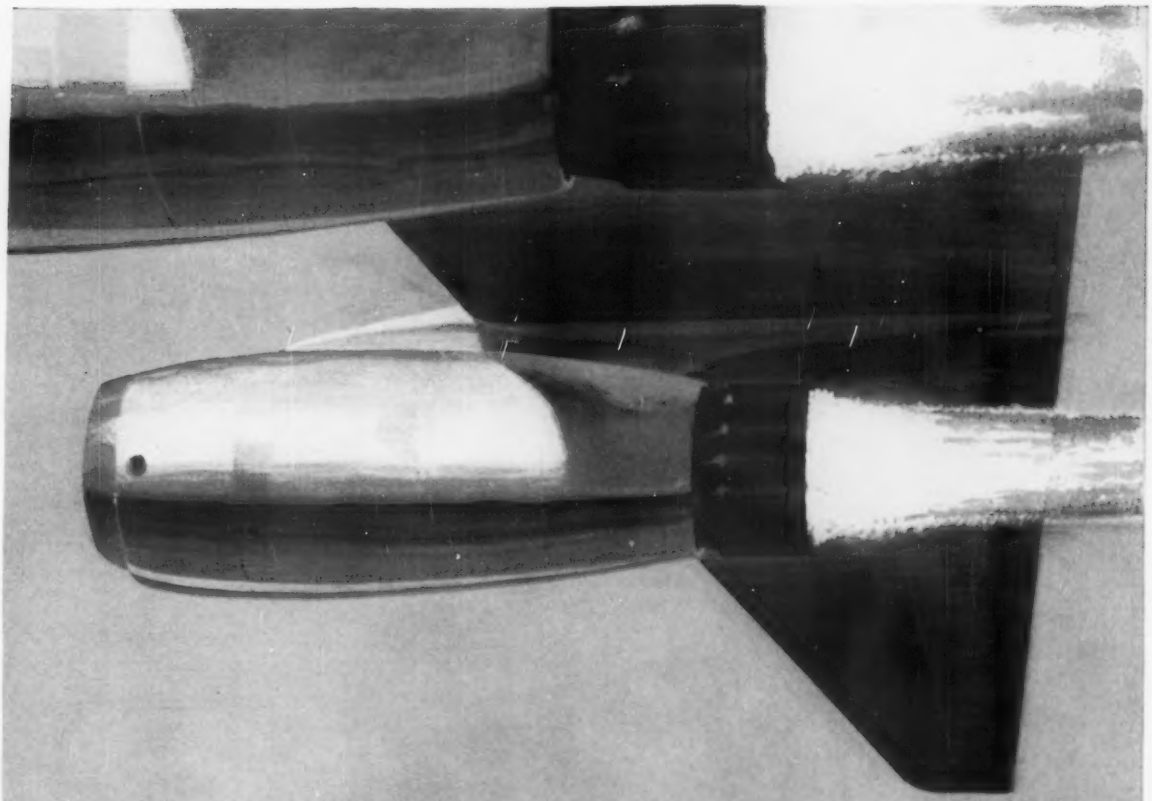
Viscount chattel mortgage holders will get $15.9 million par amount 5.5% cumulative preferred stock of United, 60,000 shares of United common stock and 7½ year warrants to buy 200,000 shares of United common stock at $45 a share, plus the 15 Viscounts.

At 00h 00m 01s GMT, August 1, 1960, Martin logged its 624,156,000th mile of space flight



Without electronics it is impossible to design, build, test, launch, guide, track or communicate with a missile. That is why 40% of Martin's 7,500 engineers are electronic/electrical engineers.

MARTIN



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Lockheed, Airlines Plan Electra Changes

Modifications begin in November; speed restriction keyed to tests, which could dictate more changes.

Washington—Lockheed Aircraft Corp. will begin its Electra modification program in November, but current speed restrictions will not be lifted on the modified aircraft until re-evaluation tests are completed.

The tests, which are now being conducted by Lockheed with the cooperation of the National Aeronautics and Space Administration, are slated for completion sometime next summer (AW Apr. 25, p. 40). It is quite possible that the final results of these re-evaluation tests could dictate further modifications beyond those incorporated in the presently planned program before the airplane can be flown at the normal cruise speeds for which it was originally certificated.

A special Lockheed management-engineering team returned to Burbank last week following a series of meetings with 13 airline operators of the Electra to discuss the modification program. As of late last week, all but National Airlines, Western Airlines and Qantas Empire Airways had reached agreement on the modification program.

The program calls for a systematic return of the aircraft to the manufacturer to enter the modification line, which is geared to handle about 20 airplanes at a time. Lockheed will assume a major share of specific improvement costs, which have been estimated at $25 million, but the carriers will cover all ferrying costs to and from the plant.

Modification program calls for a revision and stiffening of the present engine mounts and installation of additional mounts; addition of stiffeners and newly designed fittings to upper and lower engine support structure longerons and diagonal bracing. Structural members will be added to nacelle sides. Firewall and nacelle bulkheads will be strengthened. Wing planks from the fuselage out toward the wing tips will be strengthened, and some intermediate ribs will be stiffened by the addition of new bracing.

In addition, Allison Division of General Motors Corp. is adding a third bearing to the torque shaft of the turboprop engine. This improvement has not been directly associated with the reasons behind the modifications undertaken by Lockheed. Work on the modification program began July 5 with an Electra which will be turned over to the Lockheed Engineering Flight Test Department Sept. 23. The airplane will be fully-instrumented with stress gages to undergo thorough flight evaluation. First Electra modified for certification by the Federal Aviation Agency is scheduled to be ready by Nov. 16. Target for the complete certification is Dec. 16.

Typical of the aircraft flow through the modification program is the schedule which has been mapped out for Eastern Air Lines and American Airlines (AW July 18, p. 39). Electras of both carriers enter the program on Nov. 17.

American's schedule calls for five aircraft at a time, and it is expected that modification of the airline's entire fleet of 34 will be completed by July, 1961. Eastern will have three of its 40 airplanes out of service at a time between Nov. 17 and Jan. 1, five out between Jan. 1 and April and seven out from May through June.

At the present time, there are a total of 132 Electras in operation, 20 of which are operated by foreign flag carriers. Total of 23 Electras are on order for later delivery.

Chief problem facing foreign flag carriers is the ferry-time involved in moving the aircraft into Burbank for modification. Australian airlines, for example, anticipate that each airplane will be out of service for at least six weeks, compared with the 30-day period each Electra will be out of service in domestic operations—including ferry time. Most carriers are expecting heavy out-of-service revenue losses during the modification program, although several airlines will fill the schedule gap with piston-engine planes.

Western Air Lines and National Airlines are still in the talking stage with Lockheed on the proposed agreements. Northwest and Braniff have reached agreement in principle and are expected to sign a final agreement shortly. Northwest is seeking a schedule that calls for modification of its nine aircraft at a rate of three at a time.

The re-evaluation tests are a program separate from the modification program. Started last spring (AW Mar. 28, p. 40), the re-evaluation tests are being conducted by Lockheed with the cooperation of NASA, which is acting as a technical consultant to the FAA. FAA will make the final decision whether further modifications are required after the results of the re-evaluation tests have been analyzed and studied by the agency in consultation with NASA and Lockheed.

Original flight restrictions, which were to stand until the tests were completed, were set at a 275 kt. calibrated airspeed, or Mach .55, as the normal cruising speed (AW Mar. 28, p. 40). This was later reduced to 225 kt., which is the current speed restriction (AW Apr. 4, p. 43). Original normal operating speed was 324 kt.

The re-evaluation test program calls for a full review of original loading and structural criteria and a restudy of all theoretical data pertaining to the aircraft's performance characteristics.

Flight tests will be conducted in the highly-instrumented Electra now being modified to measure stress on the aircraft in turbulent areas. In addition, NASA is conducting wind tunnel tests at Langley Field to check against Lockheed's flutter analyses. A third phase of the program calls for a series of static tests. No decision has been made yet whether a test-to-destruction with an Electra will be conducted.

Approximately 200,000 man-hours have already been expended on the re-evaluation tests of the Electra's airworthiness. At one time, the work force assigned to the job reached a peak of 350 persons. In addition, staff engineers of FAA, NASA, Boeing Airplane Co., Douglas Aircraft Co. and Northwest Airlines worked in close cooperation in the over-all re-evaluation program. Details of the testing plan were worked out by the two agencies, and each has been active in interpreting findings thus far.

American Earnings Drop

New York—American Airlines net earnings for the first six months of 1960 totaled $2,621,000, down from $3,291,000 for the same period of 1959. Sales of property totaled $810,000 net after taxes for the first half of this year, compared with $5,535,000 for the first half of 1959.

The airline's revenue passenger miles increased 24% to 3,126,000,000, the coach traffic increase being 46% and first class up 12%. Air freight total was up 29% to 54,738,000 ton miles.

Non-Union Pilot Seniority Issue Sparks ALPA-Southern Dispute

By Robert H. Cook

Atlanta—Prospects for immediate settlement of the seven-week-old Southern Airways pilots' strike appeared dim last week as management and labor refused to give ground over issues which evolved into a dispute between the Air Line Pilots Assn. and all major carriers serving the southeast.

Core of the ALPA-Southern dispute is the issue of non-union pilots hired by the airline when the union pilots left their jobs. Southern insists that these non-union pilots be retained with top seniority after the strike is settled, a condition ALPA refuses to consider.

ALPA has threatened to halt all airline service to cities served by Southern through a sympathy strike by pilots of other airlines operating to these cities. This threat is being contested in court by American, Braniff, Capital, Delta, Eastern, National, Trans-Texas and Trans World Airlines, the carriers which would be affected.

These carriers have asked the U. S. District Court in Chicago for a restraining order and injunction which would direct their pilots to ignore Southern pilot picket lines. Official of cities which would be affected are considering court action to bar picketing of entire airports after conferring with Atlanta Mayor William B. Hartsfield, who has made several attempts to mediate the dispute. Cities are Atlanta, Ga.; Birmingham, Huntsville and Mobile, Ala.; Jacksonville, Fla.; New Orleans and Monroe, La.; Jackson and Greenville, Miss.; Spartanburg, S. C.; Charlotte, N. C., and Memphis and Nashville, Tenn.

ALPA terms the court action premature and says the union is prepared for a long, drawn-out battle. Southern has served notice it intends to retain its non-union pilots and expects to restore service to all of its 41 cities by mid-August, with a full schedule pattern in service by October.

Presidential Board

An ALPA sympathy strike could trigger appointment of a presidential emergency fact finding board which would recommend a solution and which the union indicates it would welcome since the company has refused to submit the strike issues to arbitration. If the courts bar the sympathy strike, the National Mediation Board sees little chance for an emergency board to be appointed.

Although ALPA has not carried out its sympathy strike threat, union publicity indicating that it will has had a significant effect on trunkline business in the Southeast.

Delta Air Lines estimates it is getting 30 to 40 reservation cancellations daily at Atlanta and that it boarded 3,100 fewer passengers last month than in July, 1959.

The airline said most of the cancellations have come from vacationers who express fears that any spread of the labor dispute might result in them missing important connections and reservations for overseas trips. Eastern Air Lines reported similar difficulties and estimated that Atlanta boardings were down 10% from the same month last year.

Few of the airlines could accurately report the effect on other major cities in the area, but they cited Atlanta with its average daily departures of 3,000 passengers as the most important traffic hub where effects of the strike would be noticed.

While proposals and counterproposals have been made by both Southern and the striking pilots, any hoped-for progress toward a final settlement hinges directly on the status of 75 non-union pilots hired by Southern to replace the strikers—a point recognized by Mayor Hartsfield and NMB Mediator Leverett Edwards, neither of whom see much hope for any agreement on basic working issues unless the pilot issue is settled first.

Southern Position

Southern contends that the striking pilot's contract demands cover "featherbedding" items which would increase the airline's subsidy needs and expenses by $665,000 over a two year period. Although the pilots withdrew a demand for "duty rig" clause providing a partial payment for pilot ground time, the airline charges the union substituted a new pension demand which would cost even more.

The airline said it fully intends to keep its new pilots whose "loyalty" enabled it to continue operations and told the strikers that any new contract must provide that the new pilots have full seniority preference over the strikers and the company have the right to refuse to employ any pilot who they feel has engaged in any misconduct during the strike.

ALPA maintains that its working condition demands are merely an attempt to gain the same contractual advantages already in common use on most trunklines and many local service airlines and as such they can not be termed featherbedding. Striking pilots say they are willing to continue discussing these issues, but not at the expense of accepting Southern's demands that they be placed on the bottom of the seniority list.

Agreeing to the airline's seniority stand, pilots said, would undoubtedly mean that only a small handful of the 147 strikers would return to work, and those would be senior men with 11 years or more experience who would find themselves on a lower seniority scale than non-union pilots employed by Southern a matter of weeks.

Negotiations between Southern and its regular pilots began in July, 1959, and continued to October when the National Mediation Board assumed jurisdiction over the talks. NMB released the parties on Feb. 17. Following the 30-day cooling off period required under the Railway Labor Act, the union set a May 4 strike date, but withdrew it to participate in three emergency mediation conferences called by the NMB.

Mediation Fails

Further discussions were abandoned, and a June 5 strike date was set after an NMB suggestion that the issues be submitted to arbitration was rejected by Southern and accepted by ALPA. Three other sessions with the NMB, called at the insistence of Mayor Hartsfield since the strike began, also have failed to break the deadlock. Strikers get $350 to $650 monthly benefits from a special ALPA assessment.

Southern was forced to drop its flight schedules from 60 a day to only four and furloughed 536 employes out of total personnel of 850 as an immediate result of the strike. Many furloughed employes have gradually been recalled as the airline has now restored service to 29 of its 41 cities on the basis of 20 daily flights. Southern flew about 25% of its usual revenue plane miles in July, and in the first month of the strike earned $111,300 in commercial revenues, compared with more than $300,000 for the same month last year. Load factors which averaged about 34% at the time of the strike were 44% on fewer flights in July, the company said.

Southern has employed 75 new pilots and said it is continuing to recruit from a backlog of applications, most of which are for copilot positions. About 30 of these new men have been checked out and are flying the line. Southern estimates the average applicant completes training and a Federal Aviation Agency check within three weeks on a schedule that is now producing five crews a week.

The new men do not have firm contracts with a written guarantee of continued employment, Southern said, but are being hired at a salary rate of $1,075 a month for captains and $425 a month for copilots, which is the

average wage of the striking pilots. Southern adds that the non-union pilots can average a little better pay than normal under an incentive plan that provides an extra allowance of as much as 10 cents per plane mile for each mile flown in excess of 9,000.

The airline also disputes ALPA claims that the non-union pilots are either unsuitable or inexperienced for their positions and contends that in a group of 30 captains hired, average flight experience was 10,500 hr. and average age was 39. A large percentage of captain applicants have come from American citizens who formerly were employed by foreign-based operations such as Iranian Airways, American-Arabian Oil Co. and several South American airlines.

Both union and management are basically in agreement on salary provisions which would provide an eight year captain with $1,321 a month for half day, half night schedules by May or June of next year. This salary would amount to $1,558 for Martin 404 aircraft, five of which will be acquired by the end of this year, Southern said. The airline added that prior to the strike it had offered the pilots increases which would have brought salaries to $18,500 annually for senior captains on Martin equipment.

The striking pilots generally agree on the salary provisions but tend to discard any earlier offers of larger pay on grounds that they have no assurance the company is getting the Martin equipment. They say the higher pay would only apply to a few senior captains in the last six months of the contract.

Comparing counter-proposals submitted by both parties on July 11 and 12, ALPA dropped its demands for a duty rig which would provide one hour of pay for each four hours away from home to improve current contract provisions which pay only for straight flight time. ALPA added a new demand that the company assume the full cost of its regular pilot pension plan under which pilots contribute 2% of their gross salary and Southern 4%. Southern complains that while the duty rig would have cost an extra $28,300 annually, assumption of the full pension plan would cost the company $29,688.

ALPA also wants an 85 hr. monthly flight limit, which would provide that any nonscheduled flying time, such as training or deadhead flights, would apply for both pay and monthly flight time limitations. The strikers contend this is a standard provision on many airlines, but Southern contends it is not needed since their pilots have usually averaged 76 flight hours a month. The pilots want at least 2.8 hr. credit and pay for any time missed because of training programs, on grounds that they could find themselves in a position of being assigned to training for as long as two weeks and then being forced to fly 60 hr. in the remainder of the month without any opportunity to regain the pay loss of 25 hr. Southern takes the stand that such training is for the purpose of upgrading and thus affording a higher salary to the pilots. They add that Southern expects to begin Martin 404 transition training this fall.

Southern also is opposed to the strikers' demands that the airline provide a minimum of one reserve captain for each five trip bidders and points out that such a change would require the hiring of more pilots at additional expense. This point, along with two other working grievances, was submitted to NMB last year for arbitration.

These demands, plus smaller issues involving an increase in sick leave time, pay for flights scheduled but later canceled and meal allowances, Southern contends, would raise the airline's annual expenses about 36%.

As an added demand, ALPA wants a signed letter of understanding that the airline will agree to negotiate the matter of additional flight crew members whenever the problem might arise. ALPA spokesmen said this was added "in the future event" that Southern might get larger equipment requiring a three man crew. The airline now operates 23 DC-3s.

Anti-Violence Measures

Southern got an anti-violence injunction against the strikers in both Atlanta and Memphis after reports that the property of one of its non-union pilots had been vandalized. In addition, the airline has guards around its hangars and a special guard for training non-union pilots domiciled in an Atlanta hotel at company expense.

ALPA denies the vandalism charge and says it has offered a reward of $100 for any information leading to the arrest of the alleged vandal. Spokesmen for the Atlanta local contend that the vandalism charge was fostered by Southern as a means of getting the protective injunctions and creating poor publicity for the strikers.

Striking pilots view their demands as an effort to gain pay and working conditions on a par with pilots employed by airlines with operations comparable to Southern.

Mayor Hartsfield told AVIATION WEEK that his greatest concern over the issue, "which should have remained on a local basis," was the entry of an "international organization" in the strike and the threat it poses to the public interest. He takes particular issue with ALPA threats to shut down airline operations throughout the Southeast as tampering with the "sovereign rights of the public" and promises to take immediate court action should any move be made to picket or interfere with operations at the Atlanta Municipal Airport.

FAA Limits Insurance Hopes Airports Follow

Washington—Federal Aviation Agency clamped a ceiling of $165,000 last week on the amount of airline trip insurance a passenger may purchase at the Washington National Airport for a single ticket.

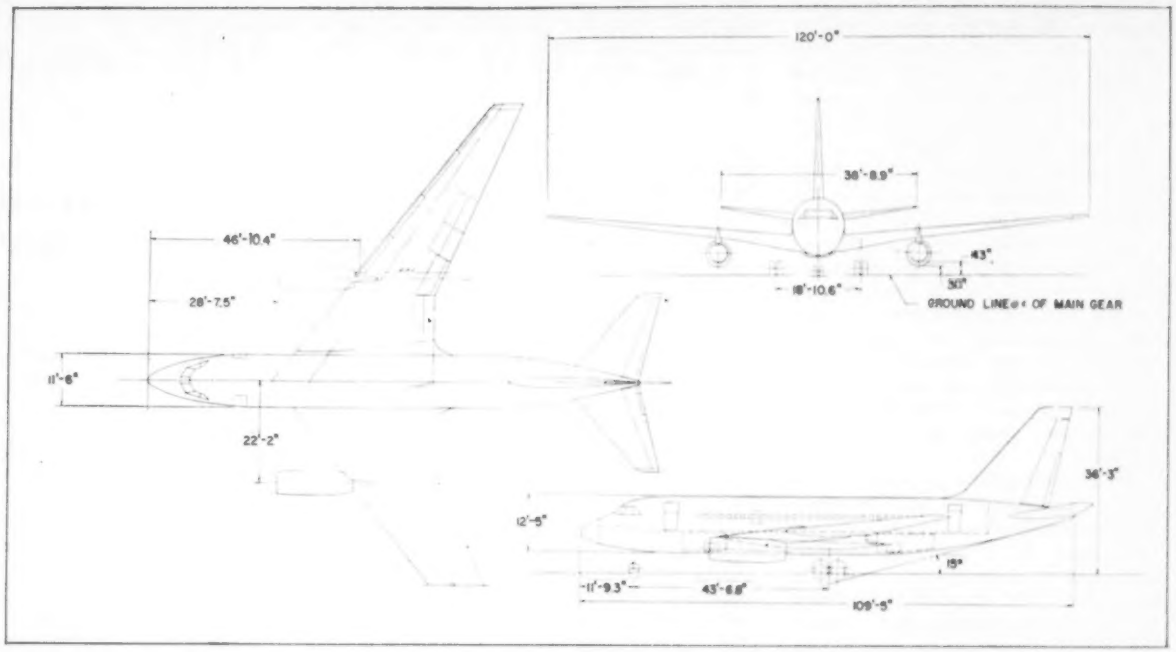
FAA, which operates the airport for the federal government, hopes the limitation will be introduced at other commercial airports throughout the U.S. Currently, it is possible to buy as much as $425,000 trip insurance at Washington National for each ticket, but FAA Administrator E. R. Quesada told AVIATION WEEK that investigation indicated substantially larger amounts can be purchased at a number of large airports in the U.S.

Purpose behind the FAA move is to reduce the cost of trip insurance premiums and to discourage bomb incidents as a means of collecting on insurance. The airport restriction has no bearing on the volume of term accident insurance a person may purchase elsewhere.

Quesada said policy costs will be reduced by switching from the present system of charging insurance concessionaires a percentage of insurance sold each year to a flat fee for rented counter space. Under the percentage system, FAA has been collecting as much as $280,000 on the approximately $500,000 in insurance sold annually at Washington National. Under the revised procedures, FAA's revenues will be cut sharply to about $140,000.

FAA feels this savings in rental fees should be passed on to the traveler, and, therefore, it will grant franchises under competitive bidding based on the premiums to be charged insurance purchasers "while preserving or improving terms of coverage in present contracts." The ceiling on the volume of insurance that can be purchased is expected to put a damper on spontaneous attempts at in-flight self-destruction.

FAA also feels that because air travel is becoming increasingly safe, cost of insurance to the passenger is inordinately high for the risk involved. The agency also said it believes that the amounts of insurance which can be purchased at an airport should bear a "reasonable relationship to the normal risk of the traveler's normal insurance needs."



CONVAIR'S proposed short-range jet transport, the Model 60, has exterior configuration similar to the Convair 880.

Convair Surveys Market for Model 60

Washington—Convair Division of General Dynamics Corp. is conducting a market survey for its proposed short-range jet transport, the Model 60, which can be available for delivery approximately two years after initial orders are signed.

Designed primarily as a replacement for the Convair 240, 340 and 440 series, the Model 60 is a swept-wing transport powered by two turbofan engines to meet requirements for a high capacity, high-speed, short-range transport at a low operating cost per airplane mile. It will sell for $3.5 million.

Powerplant Choices

Performance figures projected by Convair are based on the use of two Pratt & Whitney JT3D-10 turbofan engines, each rated at 20,000 lb. sea level static thrust. Similar performance can be attained with two General Electric CJ805-41C1 turbofan engines, rated at 22,000 lb. sea level static thrust each. Engines are pylon-mounted under the wings.

The Model 60 combines the aerodynamic, structural and systems design of the Convair 880 and 600 transports with an exterior configuration similar to the 880. Wing area of the Model 60 is 2,000 sq. ft. and span is 120 ft. Wing sweep is 35 deg. at 30% chord. Dihedral is seven degrees, root incidence is two degrees and aspect ratio is seven. The wing will be equipped with double slotted flaps and extendable slats on the leading edge.

Fuselage length is 109 ft. 5 in., with a maximum outside width of 11 ft. 6 in. Maximum height of the fuselage is 12 ft. 5 in. Forward lower cargo compartment will have a capacity of 208 cu. ft., aft lower hold will have a capacity of 255 cu. ft.

Total of 17 seat rows with a 38 in. seat spacing in a four-abreast configuration will provide 68 seats. Five-abreast seating arrangement will provide a total of 85 seats.

Mixed tourist, first-class configurations are possible at various ratios through the installation of a bulkhead in place of one seat row.

Lavatory, buffet, carry-on luggage areas and a stewardess seat are located at each end of the cabin. Forward carry-on luggage hold will have a 70 cu. ft. capacity, aft hold will have a 60 cu. ft. capacity.

Two main entrance doors 47 in. high with an average width of 30 in. are located on the left side of the airplane, one forward of the wing and one aft. Opposite the main entrance doors are 24 x 48 in. service doors. Two emergency doors give the airplane a total of six emergency exits.

Passenger windows 9 x 12½ in. are located two to a seat row. Airplane has a flight engineer's station behind the copilot seat. An observer's seat is located behind the pilot.

68-Seat Version

With a 68-passenger configuration, the Model 60 has an operating empty weight of 80,600 lb. Ramp weight with a normal payload of 14,940 lb. and maximum fuel weight of 44,000 lb. is 139,540 lb. With maximum payload of 16,670 lb., ramp weight is 141,360 lb.

Using the 85-passenger configuration, airplane has an operating empty weight of 80,860 and a ramp weight of 143,285 lb. with a normal payload of 18,425 lb. and maximum fuel weight of 44,000 lb. With a maximum payload of 19,565 lb., ramp weight is 144,425 lb.

Maximum takeoff weight of the Model 60 is 145,500 lb. Maximum zero fuel weight is 102,000 lb. and maxi-

Viscount Replacement

London—Vickers-Armstrongs is currently evaluating the engineering and marketing aspects of the ex-Hunting P.107 (July 18, p. 41), which it may produce as a Viscount replacement. The transport, which will be powered by two aft-mounted Bristol Siddeley BS-75 fan engines, will have maximum seating capacity in economy class of 53. Prime selling feature will be low purchase price, lower than that of the Viscount. The airplane has attracted U. S. airline interest.

Air Defense Exercise

Washington—Commercial airlines operating in the continental U. S., Canada and Alaska will be required to ground all aircraft for a six hour period between 1:00 a.m. and 7:00 a.m. Eastern Standard Time on Sept. 10 because of a North American Air Defense Command exercise named Sky Shield which will be conducted during that period. Exercise will employ entire radar and electronics system used in air defense.

mum landing weight is 140,000 lb.

Maximum cruise airspeed with maximum cruise thrust at 110,000 lb. aircraft weight is 586 mph. at 19,500 ft., 585 mph. at 25,000 ft., 576 mph. at 30,000 ft. and 559 mph. at 35,000 ft.

Runway requirement at sea level with a four-abreast seating payload and an 8,500 lb. fuel reserve is 3,760 ft. at standard temperatures when operating on a 200 naut. mi. flight. At standard temperatures, operating over a 1,200 naut. mi. range, runway requirement is 5,130 ft.

For the same range, but at 90F, runway requirement is 5,970 ft.

Landing runway requirement at sea level at a maximum landing weight of 140,000 lb. is 5,060 ft.

Range of the aircraft with normal payload and maximum cruise thrust at 25,000 ft. is over 1,600 naut. mi. With speed equaling Mach .82 at 25,000 ft., direct operating costs of the 85-passenger configuration model will be 1.40 cents per seat nautical mile over a 1,200 naut. mi. range.

Eastern Air Lines is currently studying the Convair Model 60 for short-to-medium haul operations. The airline has also shown substantial interest in the Boeing 727 three-turbofan, aft-mounted engine transport, although it says that Boeing has not yet indicated positive plans for building the transport. United has hinted that it is interested in a minimum of 40 Boeing 727s.

TWA, American Fined Heavily by FAA

Washington—The Federal Aviation Agency imposed unusually stiff penalties on two airlines last week for crew check and maintenance violations.

Trans World Airlines paid fines totaling $15,000 for failure to have 70 flight engineers checked for competence in the 12 months prior to Apr. 30, 1959.

American Airlines paid fines totaling $9,000 on seven maintenance violations, including one case where the carrier failed to conduct an overweight landing inspection on an aircraft.

Examiner Urges Hawaiian Airlines Be Awarded Route to West Coast

Sweeping changes in the U. S. airline pattern in the Pacific have been recommended by Civil Aeronautics Board Examiner William J. Madden, whose decision in the far-ranging Transpacific Route Case notes the need for "a new concept" consistent with the capabilities of jet transports.

Madden recommended putting Pan American World Airways and Northwest Orient Airlines "on an equal footing" with respect to West Coast coterminals for their transpacific services, thus ending a hard-fought and lengthy battle between the carriers by giving Pan American a great circle route across the North Pacific and giving Northwest a Central Pacific route via Hawaii.

Pan American, in the examiner's recommendation, would win the long-sought goal of East Coast and inland coterminals for its Pacific services, with the right to operate from Boston, New York, Philadelphia, Baltimore, Washington, Detroit, and Chicago to the Orient, with Fairbanks designated as an intermediate point.

In another aspect of the consolidated proceeding, which involved applications of some 11 carriers, Hawaiian Airlines won the examiner's recommendation for West Coast-Hawaii service.

Examiner's Recommendations

Hearings in the case began last November and followed White House urging that the entire Pacific route complex be considered as a whole by CAB. Examiner Madden also recommended:

- **Authorization of scheduled** transpacific all-cargo service by Flying Tiger Line on a five-year, non-subsidy basis.
- **Extension of Trans World Airlines'** transatlantic route beyond Bangkok to Tokyo via Hong Kong, with renewal of Bangkok-Manila authorization until Hong Kong or Tokyo service is inaugurated.
- **Renewal for five years** of South Pacific Air Lines' temporary certificate to operate between San Francisco and Los Angeles and Fiji via Honolulu, Bora Bora, Tahiti and Samoa, and new authority to carry mail on a non-subsidy basis. Passengers are to be carried between the West Coast and Honolulu only on flights operating between Honolulu and Bora Bora or beyond.
- **Consolidation of United Air Lines'** route 118 with its route 1, substituting Honolulu for Oakland and Los Angeles, respectively, as a western terminal point. Addition of San Diego as an intermediate point.
- **Extension of Pan American's** South Pacific route beyond Sydney to Djakarta.
- **Indefinite renewal of Northwest's** authority to serve points in Korea, Okinawa, and Taiwan, and of Pan American's authority to serve points in Viet Nam, Singapore, Sumatra, Java, Federation of Malaya, Thailand, Burma, and points within India and Pakistan north of the 20th parallel. Consolidation by Pan American of two Far Eastern route authorizations. One effect is to permit PanAm to fly directly between Manila and Tokyo.

In his findings, the CAB examiner described the proceeding as the first major international and overseas route case in which the impact of jet aircraft must be considered and appraised. While only "fragments" of jet experience presently exist, there is enough to establish that the new aircraft will provide almost double unit capacity, will halve flight times, will provide increased efficiency per passenger-mile "with lower fares a good prospect," and will fly greatly extended nonstop ranges.

Great Circle Routes

Operationally, this will mean full use of great circle courses will be made between major U. S. cities and points in the Orient. Economically, the new concept will assume that traffic will be stimulated "to an extent and in an amount not heretofore matched or approached by any single incident or improvement."

Madden found U. S.-Orient traffic forecasts by several parties in the case to fall within a reasonable range, and the examiner selected a total 1962 volume of 300,000 passengers as a likely expectation. Of the total, U. S. flag carriers will obtain an average of 70%, the examiner forecast.

Pan American and Northwest, however, came up with drastically different forecasts of the distribution of passengers between the eastern U. S. and the Orient, according to which Pacific route they will follow. Northwest predicted that 72% of these passengers would travel via the Central Pacific and 28% via the North Pacific; Pan American's respective percentages were 18% and 82%. The examiner found a 50-50 split to be more likely "when the giant step of the jets is weighed against the persistent pull of Hawaii as a stopover." Accordingly, he recommended that the route pattern best serving traffic between the eastern U. S. and the Orient would best be found by assuming an equal division between Central and North Pacific routings.

Airlines, MATS Meet on New Contract Plan

By Katherine Johnsen

Washington—Seven air carriers are meeting with Military Air Transport Service to negotiate contracts which will encourage the purchase of modern cargo aircraft for the civil airlift reserve.

This is the first step in implementation of a new program under which MATS plans to abandon competitive bid contracting which has accounted for over 98% of MATS business in the past. Congress and industry have long objected that the competitive bid practice permitted carriers no reserve to increase their modern cargo fleets.

The carriers attending sessions, held at MATS headquarters at Scott AFB, Ill., are Pan American World Airways, Trans World Airlines, Northwest Airlines, Seaboard and Western Airlines, United Air Lines, Alaska Airlines, and Braniff Airways.

The conferences are dealing with contract terms for the shipment of MATS passenger and cargo traffic on regularly scheduled commercial flights. This is one of three categories under the new USAF program (AW May 16 p. 39) recently approved by the Department of Defense. Four of the carriers—Pan American, Trans World, Northwest and Seaboard—previously submitted an offer to ship government traffic at reduced rates over their regular routes, but exact rates were not proposed (AW Nov. 16, 1959, p. 47).

The two other categories of traffic under the new USAF program are:

• **Traffic moving** in plane load lots. This will be produced by competitive negotiation. MATS expects to open negotiations for movements in this category in mid-August.

• **Small business** set-aside traffic. The USAF program states that this will be "in a quantity sufficient to assure adequate participation by small business."

The deadline for negotiating new contracts is Sept. 30 when current MATS contracts, totaling $42 million, expire. Two major objectives of USAF in its negotiated contract program are to obtain commitments from carriers to purchase turbine-powered cargo aircraft and to expand capacity available to MATS in an emergency or partial mobilization period. Carriers already have made commitments from their fleets in an all-out emergency period under the Civil Reserve Air Fleet program. USAF has been unable to obtain fleet commitments for partial mobilization, primarily because the extent to which a carrier's fleet might be withdrawn for military work would affect its competitive position with other carriers.

The Air Force program states that advertised bid contracts will be resorted to if the negotiated contract policy fails to achieve its objectives at "prices acceptable." Defense Department supported this in its report approving the USAF program, stating:

"It is understood that advertised competitive bidding will be used for the procurement of augmentation airlift when terms and rates acceptable to the Department of Defense cannot be obtained through negotiation."

The original Air Force program would have made negotiation of MATS contracts contingent upon the acquisition of turbine-powered aircraft by the commercial carriers. This was overruled by Defense Department, and carriers acquiring jets will only be given preference. Defense also directed USAF to consider DC-7F and L-1049H cargo aircraft "as being modern."

An Air Force spokesman told AVIATION WEEK that carriers with Canadair CL-44s, the first turbine-powered cargo aircraft that will be available commercially, will have "the pick of the MATS business" under negotiation procedures. The three carriers that have ordered CL-44s are Flying Tiger Line, Seaboard and Western, and Slick Airways.

Meanwhile, USAF reported these developments in its program to modernize MATS' own cargo fleet:

• **Advanced "workhorse" aircraft.** Air Research and Development Command is scheduled to submit final and detailed System Operational Requirement to Air Materiel Command for procurement action by Sept. 1. USAF and Federal Aviation Agency have already reached basic agreement on the characteristics of a cargo aircraft suitable for commercial and military operations. Congress appropriated $50 million in the Fiscal 1961 budget for research and development on this advanced aircraft to replace the C-124 as backbone of the MATS fleet.

• **Interim modernization.** USAF has decided to buy 50 Lockheed C-130E aircraft (C-130B with extended range) to meet Army airlift requirements—air drop and short field capabilities—under its 100-aircraft program for interim MATS modernization. Decision on 50 cargo-version turbine-powered aircraft with fast reaction capability is being withheld pending the outcome of high-level U. S.-Canadian discussions on a possible "swap" under which Canadair CL-44s for MATS would be exchanged for U. S. fighter aircraft—Convair F-106, McDonnell F-101, or McDonnell F4H.

Following are highlights from the Air Force report on its new MATS program:

• **The present lack** of civil cargo capability necessitates the use of military airlift to carry cargo which would go on civil carriers if they had the capacity.

• **"The reduction of MATS** channel traffic operation is contingent upon two things being determined. One is the assured capability of commercial carriers at acceptable and predictable prices and committed to the wartime airlift task. The other is the amount of channel traffic that will be accomplished by the utilization of MATS aircraft in training essential to execution of its wartime airlift mission.

• **"There is no intention** to eliminate MATS global route operations. . . .

• **"Any increase" in the amount** of channel traffic given civil carriers would be commensurate with assured airlift capability produced by modern long-range turbine-powered cargo aircraft made available at prices acceptable to the Department of Defense and compatible with the effective utilization of MATS."

• **When the development program** is established for the advanced cargo type suitable for MATS and commercial operations, "consideration may be given to sharing the cost of development. In this connection, civil carriers may support flight test and acceptance costs. Consideration may be given to sharing in initial deliveries to make unit costs equitable between military and civil procurement."

Conspiracy Charged

Washington—Overseas National Airways told the Civil Aeronautics Board last week that four airlines and the Air Transport Assn. are conspiring to drive Overseas National and other supplemental carriers out of military airlift.

In a complaint filed with the Board, Overseas National charged Pan American World Airways, Northwest Airlines, Trans World Airlines and Seaboard & Western Airlines with studying bids submitted by ONA and the other supplemental carriers to the Military Air Transport Service for military airlift contracts for the period Oct. 1, 1958 to Sept. 30, 1959, then agreeing to submit bids lower than the supplemental carriers' bid.

Overseas National also accused the Air Transport Assn. of submitting to the Defense Department an ex parte report attempting to persuade Defense to "substantially discontinue utilizing the services of ONA and other air carriers not certificated . . . and to effect an arbitrary diversion of military foreign air transportation over the routes of the carrier defendants from ONA and other air carriers. . . ."

Soviets Push Foreign Sales of Il-18

Soviet Union, satisfied that the Il-18 turboprop transport meets all Aeroflot's operational requirements, continues to push the aircraft in foreign markets. Czechoslovak Airlines, latest of foreign flag carriers to purchase the transport, is operating the Il-18 on its Prague-Damascus-Baghdad route (AW July 25, p. 50). Il-18 is also operating on Chinese Civil Air Service route between Canton and Peking (AW Dec. 21, p. 32) and on East Germany Lufthansa routes (AW Apr. 11, p. 45). Airplane, above, is seen at Damascus Airport.

A. V. Roe Proposes Swing-Tail Assault Freighter Based on 748

By John Tunstall

London—Avro 758, an assault freighter version of the 748 turboprop transport, is being proposed to the British and Indian governments by A. V. Roe & Co., Ltd.

The project would mount the 748 wing high on a new fuselage with a swing tail. Main landing gear would be attached to the fuselage, rather than to the wings as on the 748 (AW July 11, p. 118). The 748 cockpit would be retained.

The Avro 748 has made 20 flights for a total of 60 hr. since the first flight on June 24. Avro chief test pilot J. G. Harrison said the ailerons tend to lightness at maximum speed and heaviness at lower speeds. Tabs are being fitted in an effort to correct the fault without resorting to vortex generators. Otherwise, Avro reports no engineering difficulties with the aircraft.

On its first flight the 748 flew at the design pressurization figure and was equipped with all systems. The interior was sound-proofed but not trimmed. The aircraft has since flown at its maximum design weight of 35,100 lb. and to a speed of 270 kt.

Stalling characteristics have been investigated in various configurations, including full power in a rear center-of-gravity combination. About 200 stalls have been made. The full center of gravity range has been investigated with the aid of a water ballast system in the aircraft which enables a full center of gravity shift to be made in 4 min. Air Registration Board pilots have flown the 748 in all stalling configurations.

The 748 last month was taken out of the flight program for three weeks for a structural check and for minor changes, including incorporation of engine autostabilization, relocation of the parking brake and some cockpit changes.

Some rearrangement of the cockpit throttle quadrant is to be made to facilitate installation of a Decca navigator log. All warning lights in the cockpit are designed to go on prior to cockpit check, as in the Avro Vulcan bomber. At takeoff all warning lights should be off.

Test flights have been made with radar navigation aids installed, and a navigator to relieve the pilot of navigational duties.

The second Avro 748 prototype is expected to fly in December. The first production 748 is scheduled to fly next spring. In addition to those aircraft, two airframes are being built for testing. One of these will undergo fully simulated flight cycles to destruction.

Four fuselage jigs and three double wing jigs have been prepared to meet a production rate of four aircraft a month.

Production of 10 Avro 748s was originally authorized, but production of an additional 20 sets of components has now been approved.

Deliveries of 748s to airlines will begin this year, although A. V. Roe does not expect full certification until April.

The company has firm orders for eight 748s. Five of these are for Series 1 aircraft, powered by two Rolls-Royce Dart R.Da 6 Mk. 514 turbine engines rated at 1,740 eshp. each; three of the firm orders are for Series 2 748s, powered by two Rolls-Royce Dart R.Da 7 Mk. 531 turbine engines rated at 2,105 eshp.

Indian ministry of defense has received the first set of production parts and has made the first set of jigs for licensed production of the 748. First phase of manufacture in India will be confined to assembly with machining operations completed in Britain. Ultimately the Indian government intends to produce powerplants and components such as the landing gear. The prototype 748 is powered by two Rolls-Royce Dart Mk. 514 turbine engines.

ROLLS-ROYCE BY-PASS JETS

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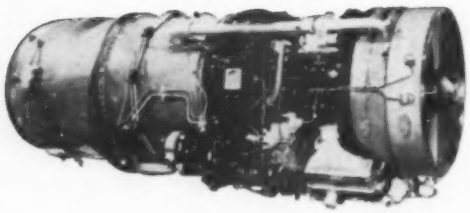
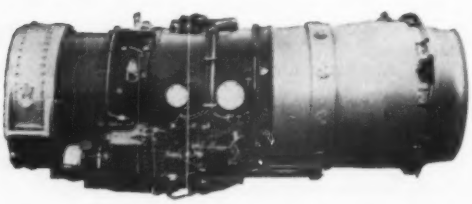
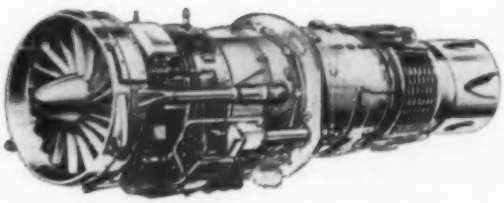


Conway by-pass jets entered service this year in Boeing 707-420 and Douglas DC.8/40 jet airliners. The Civil Conway is being developed to powers over 20,000 lb. thrust with improved fuel consumption and will power the Vickers VC.10.

THE BY-PASS PRINCIPLE PROVED BY THE CONWAY IS NOW GENERALLY ACCEPTED AS THE CORRECT FORMULA FOR JET TRANSPORTS



The RB. 141 will power later versions of the Sud Aviation Caravelle



The RB. 163 has been chosen to power the Airco DH.121.

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SHORTLINES

► **American Airlines** is adding a fifth daily transcontinental DC-7F all-cargo flight to its schedule this week. The DC-7F, converted from the DC-7 passenger transport, will fly New York-Los Angeles with a refueling stop at Chicago. The four other daily DC-7F transcontinental flights make one traffic stop en route. The new cargo flight will continue on to San Francisco from Los Angeles.

► **Japan Air Lines** has leased from American Telephone and Telegraph Co. automatic sending and receiving equipment capable of transmitting about 325,000 words a day and has integrated the equipment into its new systemwide telecommunications network linking U. S. offices with JAL offices in Asia, South America and Europe. The system operates by international cable and teletypewriter. JAL begins Douglas DC-8 service from U. S. West Coast points to Japan Aug. 12.

► **Scandinavian Airlines System** is now offering teletype ticketing. When a reservation is made, SAS sends the ticket via teletype, and it is printed on preprinted ticket paper in the client's office. SAS says it is the first foreign flag carrier to use this method of ticketing, which is now used by some U. S. flag carriers.

► **Slick Airways** has been denied blanket authority by the Civil Aeronautics Board to operate up to five transpacific cargo charter flights a month on return trips from Tokyo and Manila. The carrier operates 15 one-way westbound flights a month for the Military Air Transport Service under contract and says the number of backhaul charter flights is very small. The action was opposed by Pan American World Airways and Northwest Airlines, which said there was no showing of public need for the proposed services.

► **Transportes Aereos Nacionales, S. A.,** has been granted a one-year renewed temporary foreign air carrier permit by the Civil Aeronautics Board authorizing it to operate scheduled flights between Tegucigalpa and San Jose, Honduras, and Miami via Belize, British Honduras. During the one-year period, the carrier must not operate from Miami to points south or east of Honduras.

► **Vancouver International Airport** has launched new construction totaling $12 million under contracts just signed. Projects include a $5.5 million Trans-Canada Air Lines turbojet maintenance base, a $2.5 million, 7,300 ft. runway and $1.4 million for taxiways.

AIRLINE OBSERVER

► Rolls-Royce is experimenting with an Avon turbojet engine with a rear fan. Bristol is still pressing Vickers to consider an Olympus turbofan engine with rear fan as the powerplant for the Super VC.10 transport, although the Olympus fan conversion is still only a design study.

► **Boeing Airplane Co. is listing a $6.25 million purchase price for its proposed Model 735, swing-tail version of the 707 Intercontinental turbojet transport. Price is geared to a minimum purchase of 10 aircraft, with deliveries promised 18 months after a contract is signed.**

► Pan American World Airways is not buying engines for its recently ordered three Boeing 707-320 turbojet transports. The airline expects to be in such good shape with its spare-engine supply by the early 1961 delivery date of the additional Boeings that it will have no need for new engines. Spare engines probably will be flown to Seattle and installed on the airframes so the planes can be delivered. Pan American attributes its present spare-engine position to success of its overhaul base operation at New York and parts-pooling arrangements with foreign carriers overseas. The airline has optioned a fourth 707-320, which would bring the fleet total of this model to 27.

► **Watch for a contract between Pan American World Airways and the Department of the Interior to provide airlift services in the Marianas Islands, held by the U. S. in trusteeship under the United Nations. Pan American is expected to operate three Grumman SA-16 twin-engine amphibians in the South Pacific area.**

► Eastern Air Lines will furlough 136 pilots and 45 flight engineers Aug. 31. Retrofit program on the carrier's Lockheed Electras, retirement of Lockheed 749 Constellation and slow pace of jet deliveries are given as reasons behind the cutback. The airline warned that recall should not be anticipated before "late 1961."

► **Soviet Union's Il-18 turboprop transports, which are rapidly becoming the workhorses of Aeroflot's fleet, have been carrying substantially larger maximum passenger loads than originally contemplated. Designed to handle 75-100 persons, Il-18s have recently carried as many as 130 passengers on nonstop flights of 3,000 mi. or more. Even the Il-18's new short-haul version—still under development—has an official capacity of only 125 seats.**

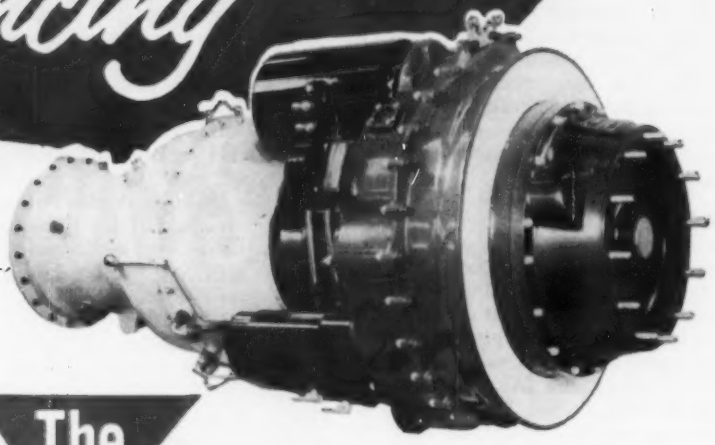
► Expansion of commercial airlift of regular first-class mail is continuing at a moderate pace although the Senate and House have yet to agree on the extent to which the Postmaster General may use airlines to move regular mail in the absence of adequate ground services or to accelerate delivery (AW July 4, p. 41).

► **Capital Airlines last week received a one week extension in the deadline for answering a Vickers-Armstrongs foreclosure suit filed Apr. 16 (AW Apr. 18, p. 38). Late last week, the company's board of directors was scheduled to study a refinancing plan for submission to the Vickers group.**

► Decision whether American Airlines' San Francisco service award will withstand the challenge that the airline used "improper influence" in winning nonstop rights between New York and San Francisco or whether the new authority will be revoked will probably rest on this issue: if correspondence from congressmen and other parties supporting American's case was received by the Civil Aeronautics Board within the prescribed time for the filing of briefs and if copies of such correspondence were sent to all interested parties, then there has been no violation of CAB's Rules of Practice. United Air Lines and TWA have accused American of using undue influence in obtaining the nonstop rights. The Board investigation of the case was ordered by U. S. Court of Appeals.

► **Federal Aviation Agency last week certificated the Pratt & Whitney JT3D turbofan engine which will power the Boeing 707-120B and 720B transports as well as the fan version of the Douglas DC-8.**

Announcing



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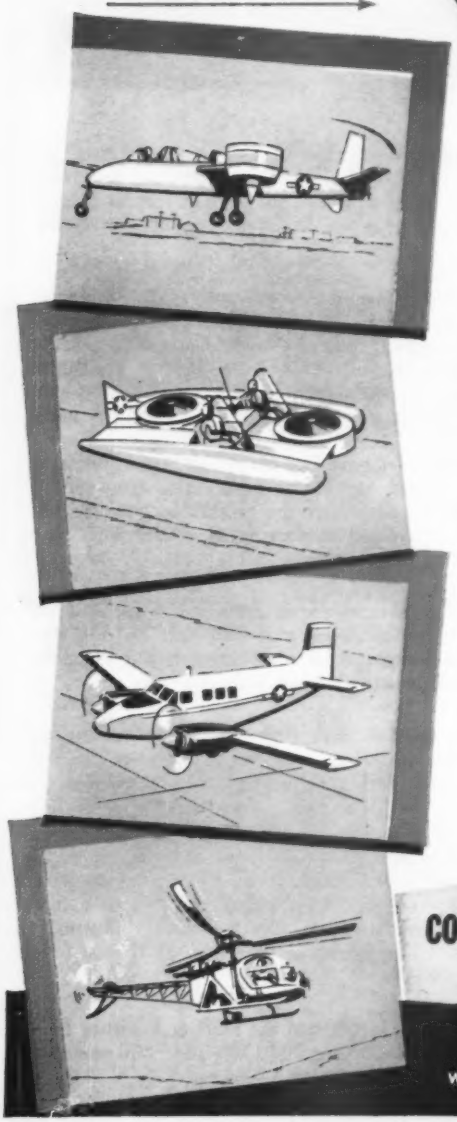

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Disputes Rise Over New Capacity Policy

By L. L. Doty

Washington—A reshaping of U.S. foreign civil aviation policy that could force a breach between the U.S. and at least three European nations is now in the making.

This policy change, which is designed to strengthen the competitive position of U.S. flag carriers in European markets, will be put to its first test Sept. 12 when the State Department meets with a Scandinavian delegation in Copenhagen to discuss revisions of a bilateral air transport agreement. The outcome of these talks will determine the course the U.S. will follow in negotiations with The Netherlands and Belgium.

In essence, the U.S. will seek to tighten restrictions on the volume of traffic carried from the U.S. beyond Scandinavia to other foreign countries by Scandinavian Airlines System—the airline consortium representing Denmark, Norway and Sweden. U.S. also will seek to police this control of traffic through a reciprocal exchange of traffic figures showing origin and destination of passengers carried.

The Scandinavians will fight the proposed capacity restrictions because any curtailment of the Fifth Freedom traffic handled beyond Copenhagen from the U.S.-Denmark route to other foreign countries will seriously cut into the carrier's revenues. It will oppose the proposed exchange of traffic statistics for virtually the same reason a majority of flag carriers have previously fought such proposals—such statistics are not required under a Bermuda-type agreement and private industry figures should not be made public domain.

A deadlock on these issues or any failure to reach some compromise agreement will undoubtedly move the argument up to top diplomatic levels. The international significance major nations are now placing on civil aviation relations is shown by The Netherlands' reaction to its failure to reach satisfactory terms with the U.S. in bilateral talks earlier this year (AW Feb. 22, p. 25).

Dutch Resolution

At that time, Dutch Foreign Minister Joseph M. A. H. Luns said the Dutch House of Representatives had adopted a resolution supported by all political parties that charged the U.S. attitude on civil routes "does not fit into the relations between allies." He said it was the first time the Dutch Parliament had endorsed such a strong statement about any ally.

Key to the controversy brewing between the U.S. and the three Scandinavian nations lies in the widespread differences in interpretation of the provisions of the Bermuda Agreement—the air transport pact signed by the U.S. and Britain at Hamilton, Bermuda, in 1946 which has since served as the prototype for all air transport agreements signed bilaterally by the U.S. with each of 53 nations except Czechoslovakia, Iceland, Ireland, Spain and Turkey. The latter five agreements are modeled after policies set in the Chicago Convention of 1944.

The Bermuda-type agreement has been upheld officially by both the U.S. and Britain, although there are liberal groups in both countries who are advocating a less stringent formula for basic agreements—one especially that would put an end to international wrangling over routes, capacity and rates. Furthermore, few nations, other than the U.S. and Britain, favor the Bermuda precepts.

As it was finally put together, the Bermuda Agreement was a compromise settlement between the liberal, open-competition philosophy of the U.S. and the severe restrictionist policy of the United Kingdom. Consequently, it is a vague, even ambiguous document that has enabled some nations—notably India and several Latin American countries—to impose stiff capacity restrictions on the U.S. under protectionist programs through the original writing or later re-interpretation of their agreements.

As turbojet schedules multiply to create a new torrent of competition on international routes, the trend toward stiffer restrictions on capacity offered by U.S. carriers appears to grow. And with an increasing number of flag carriers now satisfied with routes they are operating into the U.S., there are few inducements remaining as bargaining wedges in U.S. attempts to block these restrictions. This has been particularly true in recent negotiations between the U.S. and Britain (AW June 20, p. 88).

The U.S. has never forced capacity restrictions on any flag carriers as a means of curtailing competition. It is a fact that, in some instances, the Civil Aeronautics Board has imposed minor curbs on a few foreign carriers in the operating provisions of foreign air carrier permits it has issued, but generally, most airlines have been free to serve U.S. cities without any limitations on traffic volume other than those implicit in the Bermuda principles.

Bermuda Agreement

The Bermuda Agreement and its counterparts provide for a control of capacity. In essence, the capacity clauses prohibit the airlines of two countries from over-scheduling by keeping schedules attuned to traffic demand. The clauses further require that the airlines of the home country will schedule flights between it and the opposite country via other countries on the route as "primary" schedules. Any schedules conducted by the airlines of the home country beyond the opposite country to third countries on the route are "secondary" schedules. Traffic carried on the latter schedules is construed by the U.S. to mean Fifth Freedom traffic (see box).

The "five freedoms agreement" was evolved at the Convention of International Civil Aviation held in Chicago in 1944. The agreement was not accepted multilaterally, and Britain refused to ratify it. The U.S. signed it and, although it withdrew from the agreement in 1946, the agreement principles have survived as a basic ingredient in most bilateral air transport pacts.

Purpose of the capacity clause is to provide a measure of control over the five freedom principles by ensuring that schedules will always be closely related to traffic demand. However, since there are no established standards governing this relationship, capacity restrictions can be set by consultation between the two governments of the bilateral agreements.

The U.S. has asked for talks on capacity with the Scandinavians in accordance with the consultation provisions. It will attempt to prove in these talks that SAS is not treating its Fifth Freedom traffic—that traffic, according to the

Five Freedoms

Washington—The Five Freedoms of the Air Agreement, which evolved as one of several agreements at the International Civil Aviation Conference in Chicago in 1944, was signed by only a few of the 54 nations represented. In all its bilateral agreements, however, the U.S. has retained the liberality of these five freedoms:

- **First Freedom**—The right to fly across a country without landing.
- **Second Freedom**—The right to stop for fuel or mechanical attention.
- **Third Freedom**—The right to discharge passengers, mail and cargo coming from the home country in a foreign country.
- **Fourth Freedom**—The right to load in a foreign country passengers, mail and cargo destined for the home country.
- **Fifth Freedom**—The right to take on passengers, mail and cargo in a foreign country destined for any other third country, and the right to discharge passengers, mail and cargo coming from any such third country.

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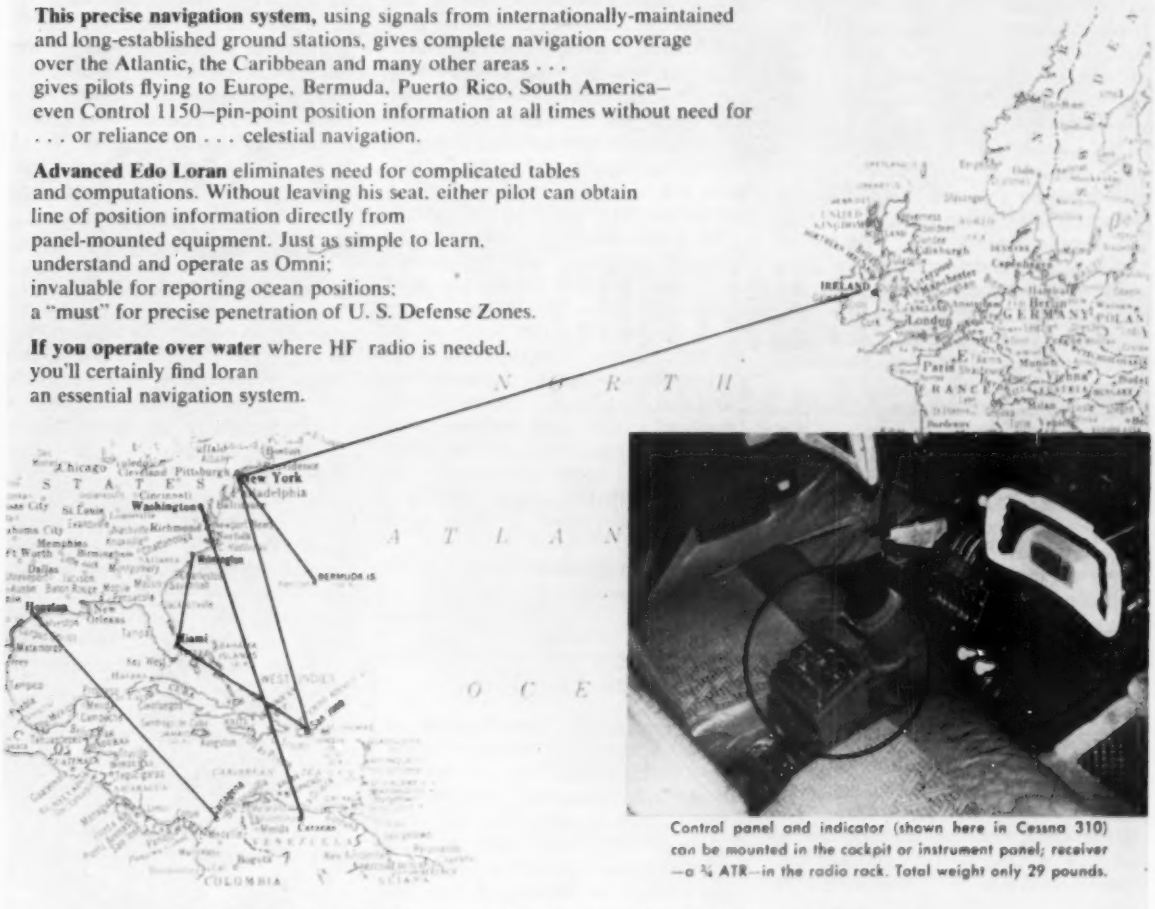

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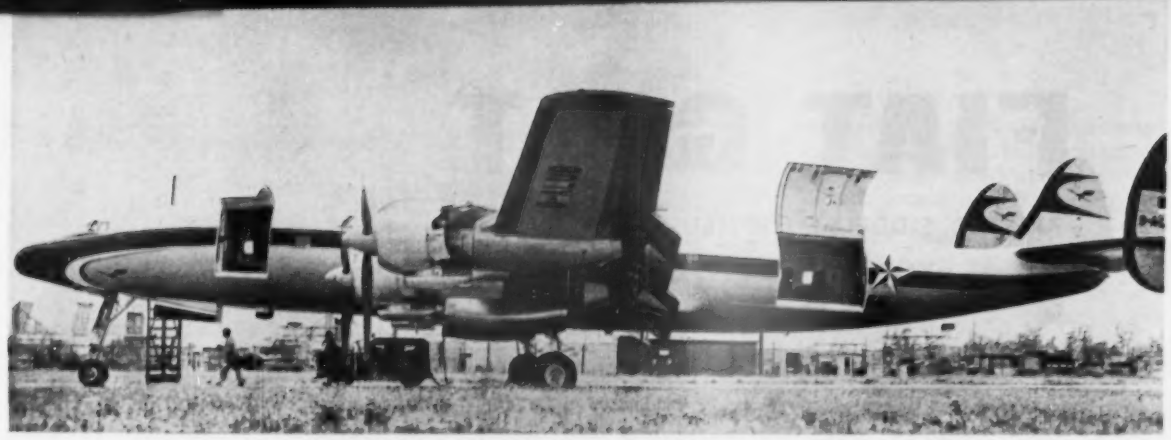
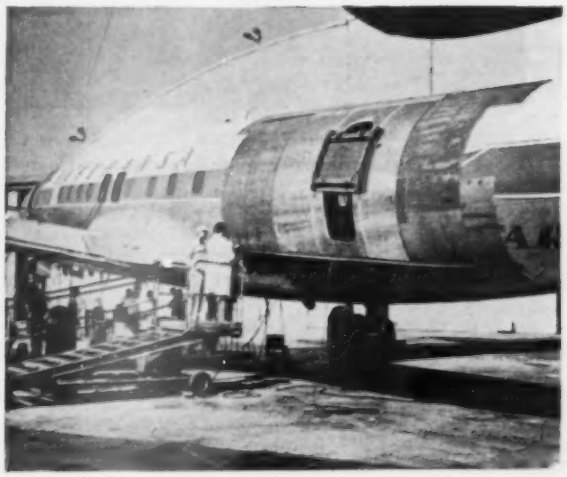


First Cargo Version of Lockheed 1649A Built for Lufthansa

Redesign of Lockheed 1649A from passenger to cargo configuration for Lufthansa-German Airlines shows large hole cut in forward fuselage for forward cargo door (bottom left) and fuselage skin replaced for rear cargo door installation (bottom right). Model 1649A has a range of over 6,000 mi., permitting nonstop cargo flights between New York and the European continent.



U.S., that moves beyond Scandinavia from the U.S. to other countries—as secondary traffic but as primary traffic, thus taking more than its legal share of such business.

The Scandinavians will argue that this traffic is not Fifth Freedom traffic but is "Sixth Freedom traffic" and is, therefore, not subject to the conditions of the bilateral. It is SAS' position that any traffic picked up en route in third countries is legally Fifth Freedom traffic, but that any traffic carried beyond Scandinavia to third countries is Sixth Freedom traffic and is outside the jurisdiction of the bilateral. It will claim that the capacity clause has been misinterpreted by the U.S. with respect to Sixth Freedom traffic.

U. S. Contention

The U.S. carriers are now arguing that only a small portion of U.S.-Europe traffic carried by SAS is destined for Scandinavia—one industry spokesman estimated the amount to be about 25% of SAS' total traffic. The balance, they charge, is Fifth Freedom traffic ultimately destined for other European cities, such as Hamburg, Paris, Geneva, Rome or Madrid, which are served by SAS.

In addition, U.S. carriers say that some of SAS' traffic is dropped off at Hamburg on transatlantic flights en route to Scandinavia. At Hamburg, SAS picks up this traffic on its local continental flights to other European cities.

U.S. airlines charge that all such traffic drains European business away from them.

SAS Position

SAS maintains that every carrier has the right to carry automatically any traffic beyond the country of its flag. It states that the bilateral agreement does not include Sixth Freedom traffic and that the agreement cannot be interpreted to include such traffic. Essentially, the Scandinavians insist that routes between national gateways are the only ones subject to the provisions of bilaterals with third countries.

Here are specific examples of SAS' position with respect to Fifth and Sixth Freedoms:

• **Traffic carried on SAS'** route between New York and Copenhagen that is dropped off at Glasgow—a third country—is Fifth Freedom traffic and subject to control under the provisions of the bilateral agreement.

• **Traffic carried on SAS'** route between New York and Copenhagen and continuing on to Rome, for example, is Sixth Freedom traffic.

In recent years, the U.S. government has made two major route grants which inherently permit a larger flow of Fifth Freedom or secondary traffic than primary or Third and Fourth Freedom traffic—a direct conflict with the government's interpretation of the Bermuda capacity clauses.

Route Award

Last year, the Civil Aeronautics Board awarded a route to British Overseas Airways Corp. from Tokyo to London via San Francisco and New York (AW June 1, 1959, p. 41) although the Board examiner had warned that the majority of traffic handled on the route would necessarily be Fifth Freedom traffic.

Earlier, Pan American World Airways was awarded a route between San Juan, Puerto Rico, and Spain and be-

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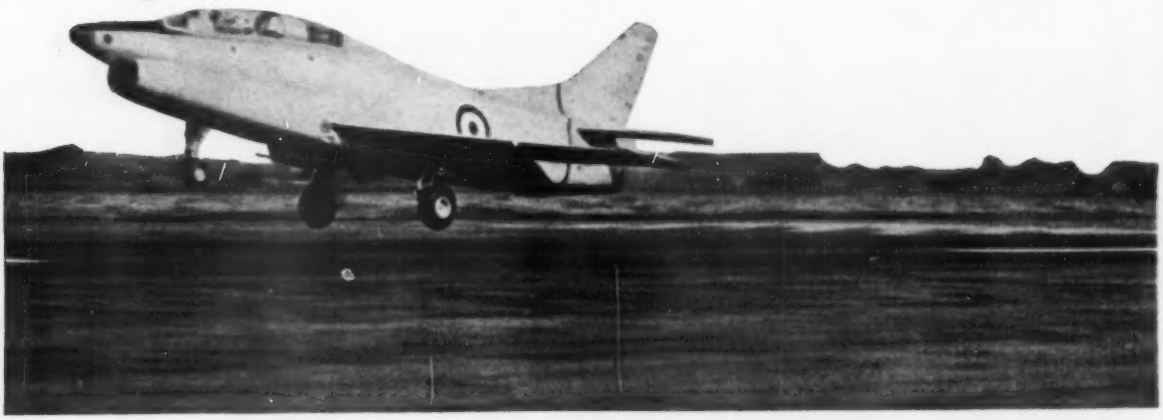

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Soviets Develop Taxi Version of Coaxial Ka-18

Version of the Kamov Ka-18 coaxial helicopter (AW Jan. 18, p. 65) has been developed as an air taxi by a Soviet design group headed by Nikolai Ilich Kamov. Aircraft is called Malyutka (Little One) and is powered by a 280 hp. Ivchenko engine. Range when used as an air ambulance is about 310 mi. but this drops to 186 mi. when used as a taxi, carrying three passengers and the pilot. All-weather flight equipment will be installed.

yond despite testimony that purported to prove that 80% of such traffic would be Fifth Freedom traffic originating in the Caribbean. It has been estimated that almost 100% of the traffic flown by Icelandic Airlines on its transatlantic route via Reykjavik is Fifth Freedom traffic.

Endorsed by Congress

The Bermuda Agreement as a prototype for bilateral agreements has been endorsed by Congress. It is supported by U.S. carriers, and the State Department has never seen fit to recommend any substitute formula as a basis for bilateral air transport agreements.

In 1957, an attempt was made to amend the Civil Aeronautics Act of 1938 by adding the Bermuda capacity provisions to the Act as a means of gaining tighter control over Fifth Freedom traffic. The bill was never reported out of committee because the Senate Interstate and Foreign Commerce Committee was convinced that other nations might be tempted to introduce similar legislation in retaliation.

The State Department, however, is now under pressure from the industry and the CAB to enforce capacity checks and has already asked Belgium, Italy, The Netherlands and the Scandinavian countries to provide origin and destination statistics as a first step in this direction. Attempts by the U.S. in the past, in concert with Brazil, to have International Civil Aviation Organization (ICAO) collect such statistics from all international airlines have not as yet been successful, although the program is under study.

Italy has agreed to provide the statistics, but The Netherlands, Belgium and Scandinavia are resisting the request. They want clearer definitions of "origin" and "destination." For example, what is a passenger's destination who visits 10 or more countries in Europe? What is his origin if he spends 45 days in Amsterdam after brief visits to several other European countries?

They also want to know what purposes these statistics will be put to by the U.S. They question the right of any country to ask that Sixth Freedom statistics be divulged. Such information, they say, is outside the province of bilateral agreements.

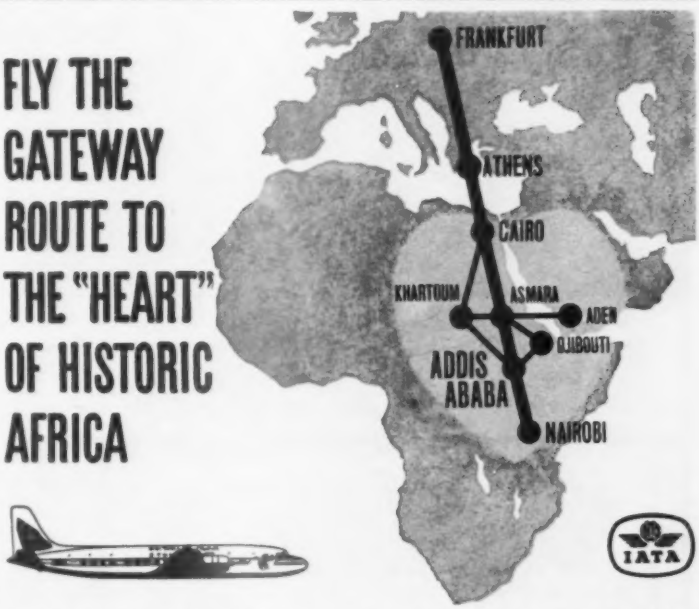
Stiffened Policy

In recent years, the U.S. has assumed a more unrelenting role in the give-and-take of negotiations with foreign nations on bilateral agreements. Breakdowns in recent talks (AW June 13, p. 38) have been attributed to this switch to a stronger position in behalf of U.S. carriers, although a number of airline officials charge that the U.S. gave away so many routes to foreign carriers in the early postwar years that the U.S. is now on the begging rather than the donating side.

Criticism of the so-called "give-away" policy of the U.S. reached a peak in 1955 when a series of routes into the U.S. were granted to Lufthansa. Since that time, the U.S. has gradually tightened its bargaining concepts under pressure from the CAB, the airlines and labor groups.

The new policy has resulted in strained relations, particularly with The Netherlands, Italy and Argentina. The latest policy—that of enforcing capacity restrictions on Fifth Freedom traffic to the letter—will undoubtedly spread this discontent to other nations.

FLY THE GATEWAY ROUTE TO THE "HEART" OF HISTORIC AFRICA



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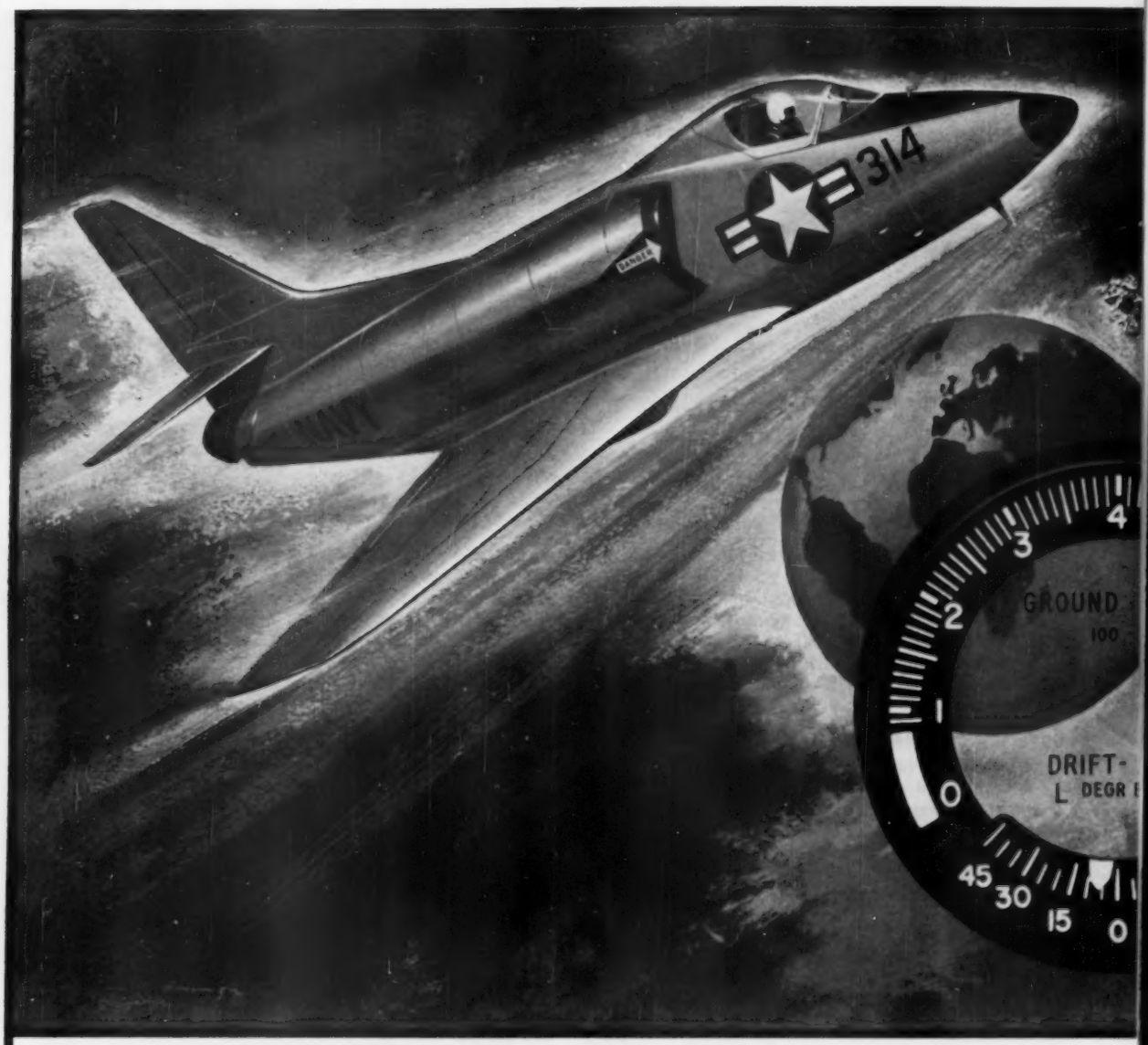
ETHIOPIAN AIRLINES

THE WONDERLAND ROUTE



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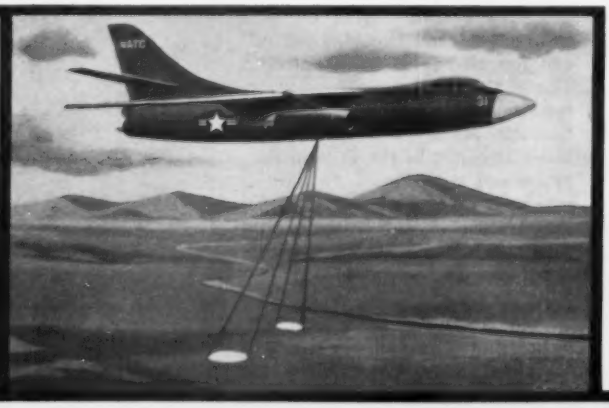

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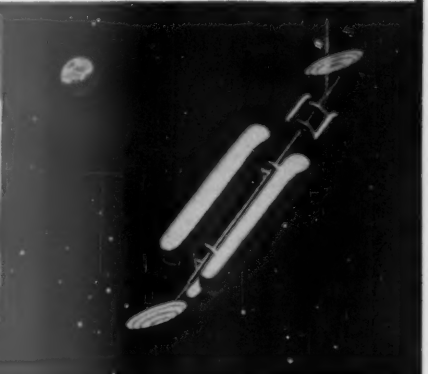

▲ **SPACE NAVIGATION.** Guiding astronauts through space, orienting space platforms, making "soft" landings on the moon are some of the problems of the future being solved today at Ryan Electronics.

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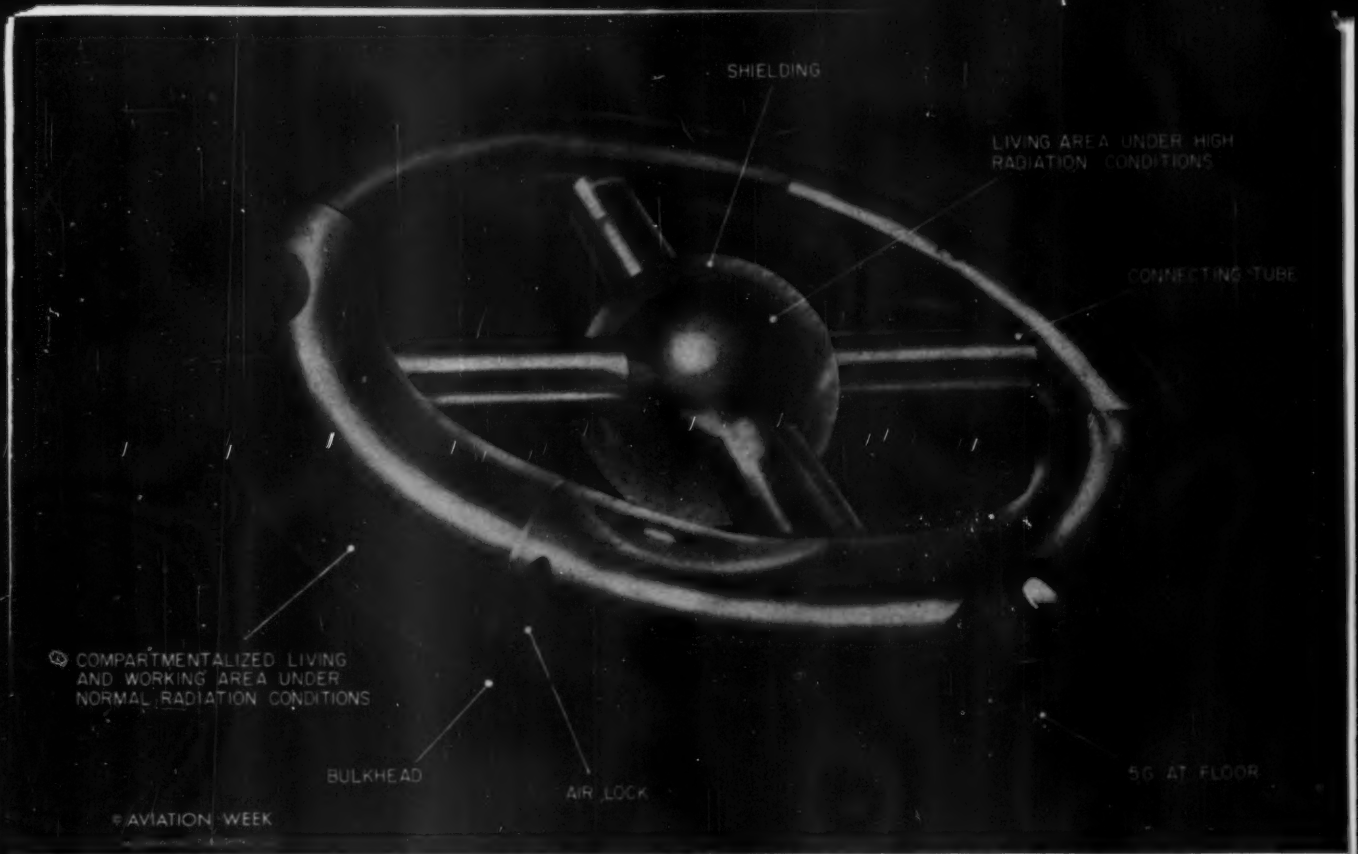
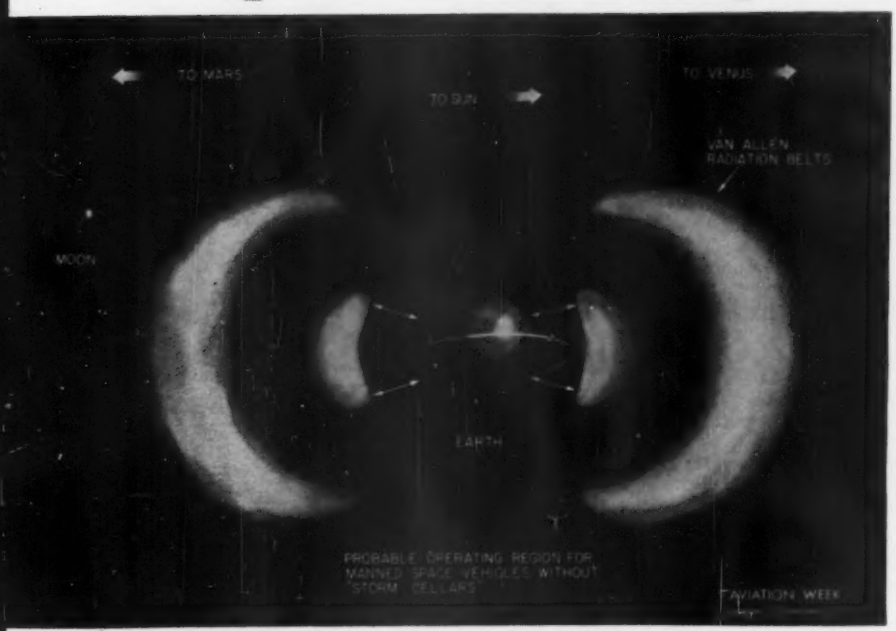


MANNED VEHICLES operating for long periods in space probably will require heavy "storm cellars" to shield their crews from radiation storms coming from the sun during solar flare disturbances. Vehicles with large internal volumes and big working spaces for their crews are planned for the third generation of manned space craft. Shielding of the crews of these vehicles against even mild radiation is out of the question unless shielding is concentrated in a "storm cellar" with a small living space inside. Measurements by satellites and balloons

Space Stations Require Radical Design,

By J. S. Butz, Jr.

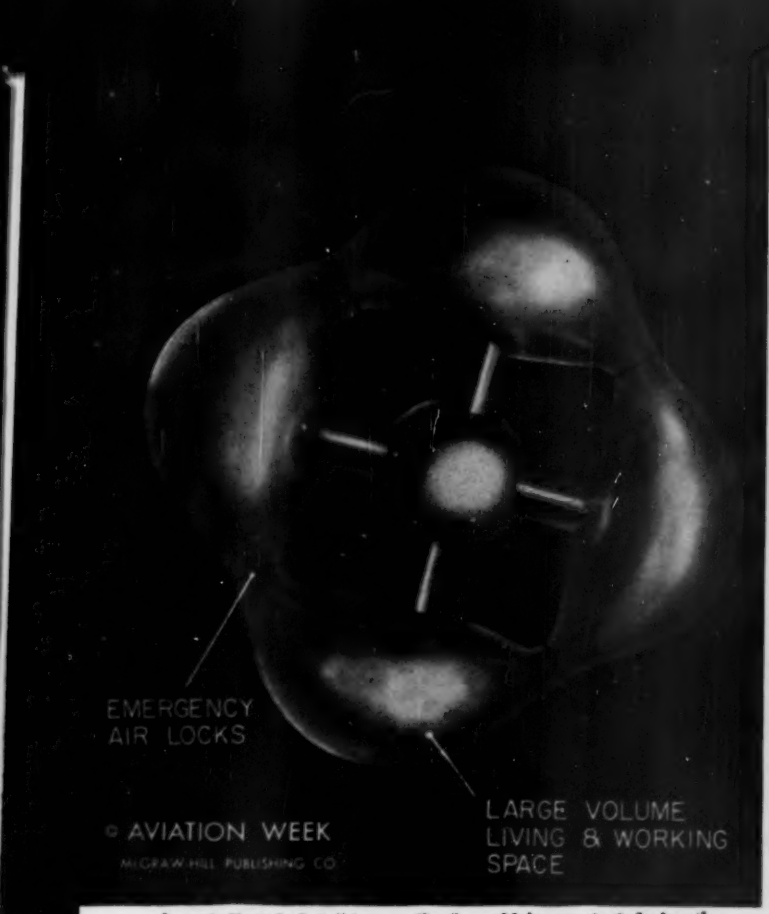


NATURE of the radiation environment in space is just beginning to be understood. If the level of background radiation beyond the Van Allen belts is too high, space travel there may be impossible until completely new shielding techniques and materials are developed. Current studies show the best orbit for a manned space station is at an altitude of about 300 mi. at the equator.

Washington—Third generation manned space vehicles are scheduled to be relatively spacious and to operate for years without major repair. This means they will require design concepts and construction materials radically different from those used in the cramped, short-lived Mercury vehicle and the second generation multiman capsule.

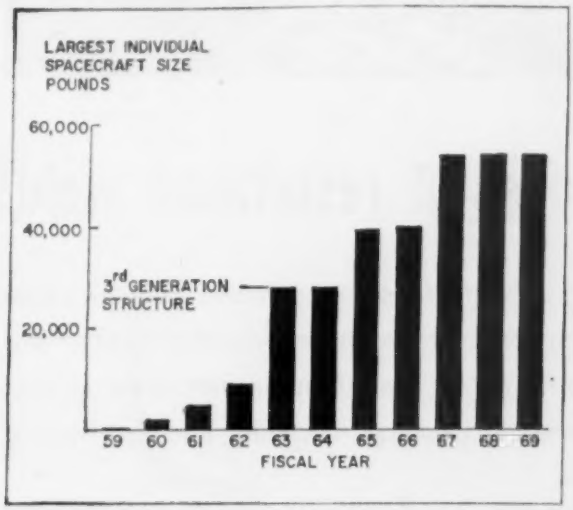
Internal working space of a 30,000 lb. third generation vehicle will equal that of a small cottage, and light, low density structure must be used to enclose this volume if the structural weight is to be kept low. Current estimates are that aircraft type structure and high density sheet metal materials will not be adequate for the pressure vessel construction of large space vehicles.

Development of new low density, high strength materials for pressure vessel construction has become a major objective of the National Aeronautics and Space Administration (AW July 11, p. 28). Composite materials using many types of synthetic rubber, plastics and ceramics as binders and thin reinforcing tapes and wires to provide high strength are being studied. A number of configurations of low density



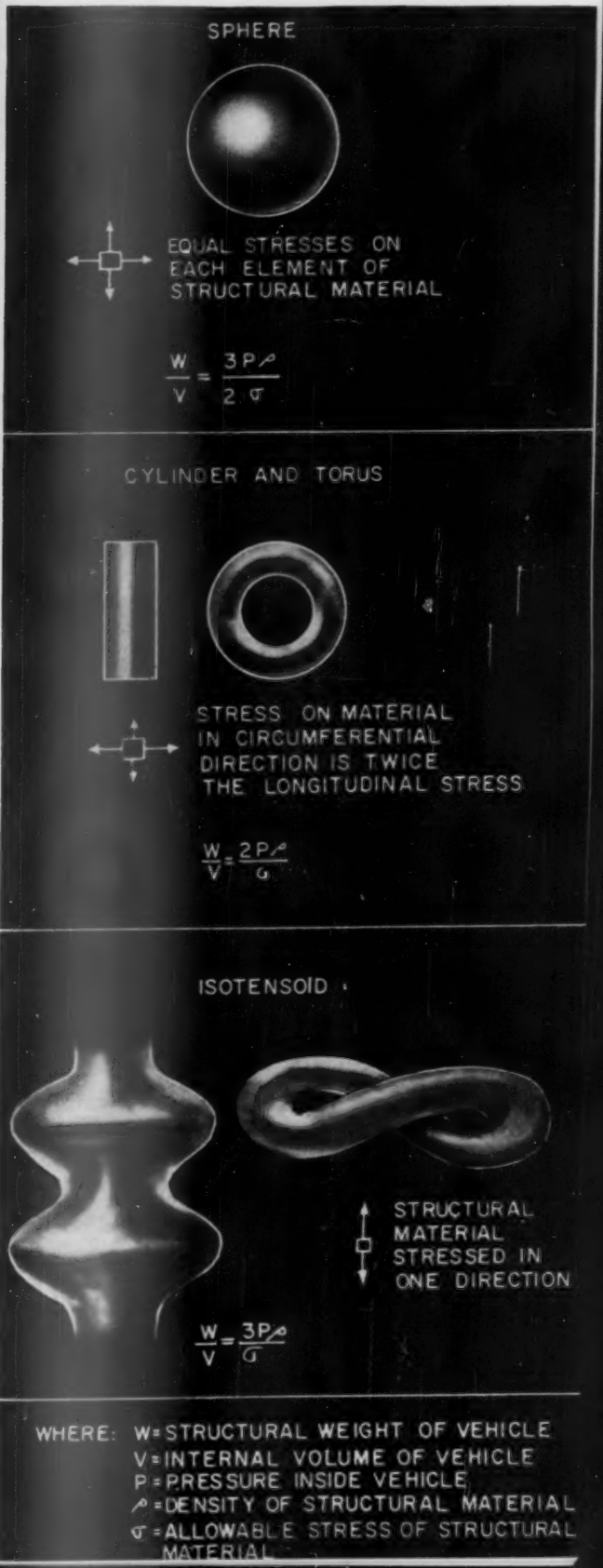
have indicated that "storm cellars" would be required during the minimum eight to 10 times a year when bursts of high intensity radiation come from the sun. These "cellars" would weigh in the neighborhood of 30,000 lb. for two or three men.

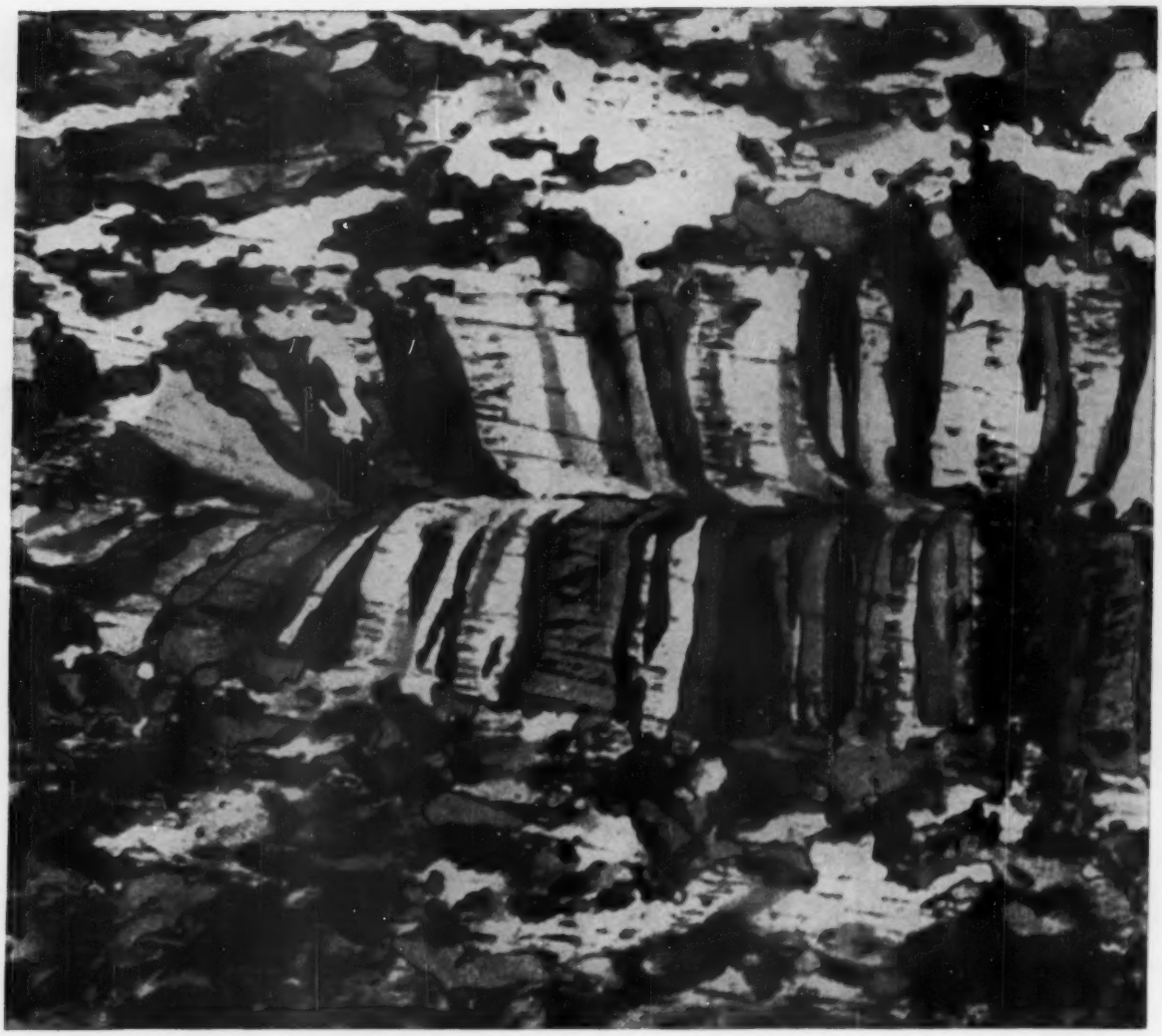
Structures



FIRST of the third generation, large volume space vehicles can be launched on the schedule shown above if booster development programs do not slip. Early models of the third generation vehicles probably will not be manned. Spherical shaped pressure vessel (right) to carry the crew of a space vehicle is the lightest that can be built of sheet material. Cylindrical or torus-shaped vehicles of similar volume and material will weigh 1.3 times as much as the sphere. Many shapes are possible if composite materials reinforced with wires and filaments are used.

SPACE TECHNOLOGY





BERYLLIUM: successful resistance weld!

This photomicrograph is visual proof that beryllium can be resistance welded. Extensive tests at the Budd Company indicate useful sheet metal products can be fabricated from beryllium. Work with beryllium at Budd includes successful hot rolling, brake forming, deep drawing, brazing, resistance welding, arc spot welding, arc welding, cleaning, machining and hot shearing.

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SPACEATOMICS Budd DIVISION

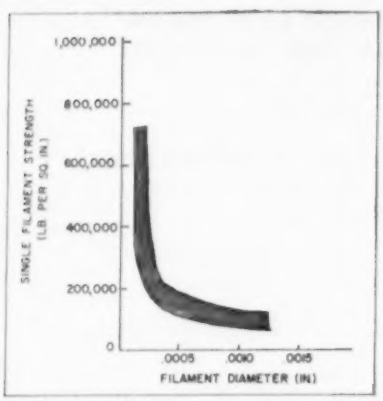
sheet metal sandwich are being investigated to determine just what types of core shape will best meet the pressure vessel and point load attachment problems for space vehicles.

The continued development of beryllium as a sheet metal structural material has been advocated strongly by NASA's Research Advisory Committee on Structural Design. Beryllium is 2-3 times stronger than aluminum and 1-2 times stronger than steel on a tensile strength-to-weight basis. If dynamic loading is the design criteria, as it will be in most space applications, beryllium is even better because it is 6-7 times stronger than both aluminum and steel on a stiffness-to-weight basis.

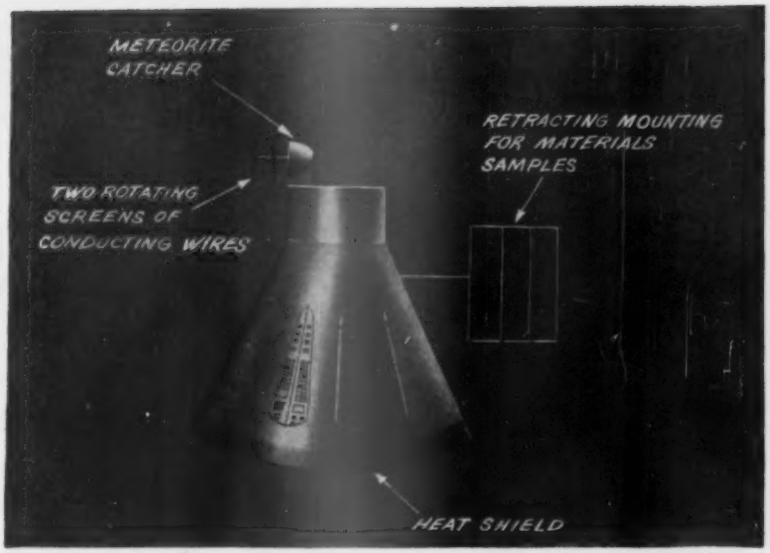
The relative value of eliminating one pound of payload weight is about 10 lb. in total vehicle weight for an aircraft, approximately 100 lb. of vehicle launch weight for a large missile and nearly 1,000 lb. for a space vehicle which can reach the moon or the near planets. The potential savings in total program costs through weight reduction in a space vehicle are believed to warrant the expense of overcoming the fabrication and brittleness problems of current beryllium alloys.

Design studies now in progress for the third generation of manned space vehicles are hampered because no clear understanding of the space environment is available and probably none will be available until the first of these vehicles is in service. Primary environmental unknowns are the speed, frequency and size of meteorites and the type and density of radiation in the regions of space near the earth and in the solar system.

Data from satellites now in orbit have provided much information on radiation and meteorites. The most important factor shown by the present information is that the quantity and type of both meteorites and radiation vary with time. Meteoritic dust and radiation "storms" are known to occur in space. It is uncertain today whether these are cyclic variations and follow some pattern which can be extrapolated to show what conditions a space vehicle will encounter during a given period, or whether the variations are random.



COMPOSITE MATERIALS planned for isotensoid pressure vessels are reinforced with small diameter wire or very thin gage metal filament which have a much higher working stress than ordinary gage sheets of the same metal. Thinner the reinforcing elements, the higher their stress, as shown in curve.



RECOVERABLE SATELLITES to test structures, materials and working systems in space are planned by NASA. Aviation Week artist's conception shows rotatable doors and extensible arms which will expose materials specimens and structural samples to the space environment. After experiment is completed, test units will be brought back behind the heat shield and returned to earth without experiencing the heat of re-entry so that changes which occurred in space can be evaluated through close study. Hemisphere extending out of top of satellite is to catch small meteorites and bring them back for study. The hemisphere would be filled with a low density material, and two rotating wire grids in front of it would be used to give a close approximation of the speed at which the meteorite is intercepted.

Solar radiation is believed to be varying in an 11-year cycle, but the character and magnitude of these cycles over a period of 50 to 100 years is not certain. It is clear that many more research satellites and many more years of work will be required to get a detailed understanding of these problems.

Even though the final answers to the radiation and meteorite questions are many years away, it has been possible to describe broad limits to these important factors of the space environment so that reasonable preliminary design work can be done on the third generation of space vehicles.

Two areas in space are of immediate interest for these manned space vehicles, and two types of radiation probably will be the controlling factors in their design. The two areas in space are:

- **Low altitude orbits** near the equator with a maximum altitude of 300 mi.
- **Cislunar space**—the area between the earth and the moon.

The two types of radiation are:

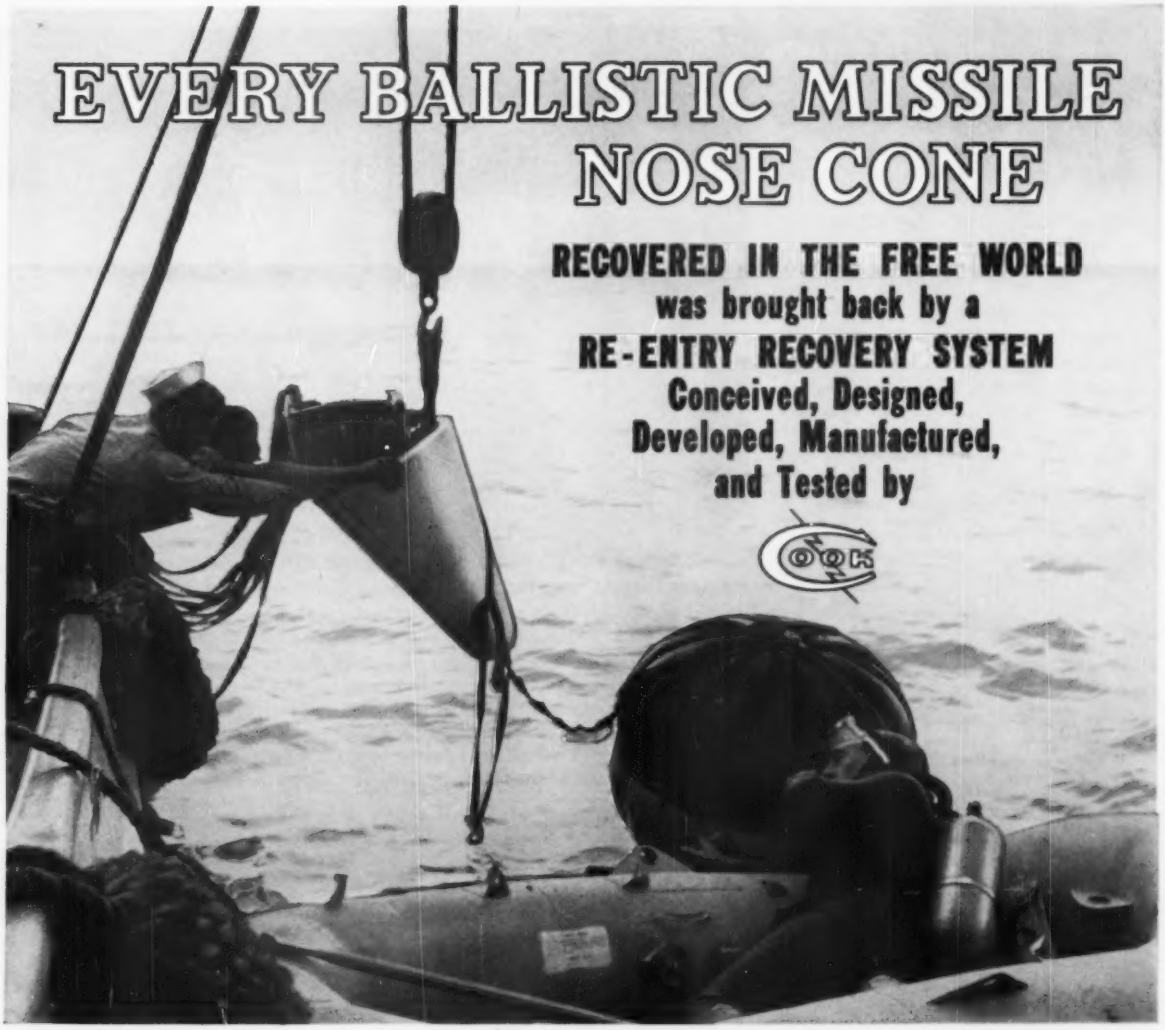
- **Background cosmic ray** radiation, which remains more or less constant.
- **Bursts of high energy** particles produced by the sun during solar flares.

It was determined from the data provided by the first satellites that some of the radiation trapped in the Van Allen belts around the earth has such a high energy level that it would be impossible for man to live in these areas for a long period even when protected by extremely heavy shielding.

Particle energies in the inner Van Allen region have been measured up to 700 mev, which would give an unshielded man his allowable weekly radiation dose in about one minute. Although particle energies in these belts vary considerably with time and position, satellite measurements to date have shown that they are so high that the shielding weight required for continuous manned flight in the Van Allen belts is not feasible in today's technology.

Background radiation below the inner Van Allen belt at altitudes of about 300 mi. or less have been judged to be completely safe for short-term manned flight. This is the area in which the Mercury capsule will make its three orbits. Radiation "storms" coming from the sun during solar flares will not be a problem with this type of flight because the capsule can complete its full flight and re-enter the atmosphere before high energy particles reach the earth even if a flare is observed during the launch.

Crew safety during long term orbiting of third generation space vehicles in



SUCCESSFUL RECOVERY OF THE JUPITER C, JUPITER, ATLAS, AND THOR-ABLE BALLISTIC MISSILE NOSE CONES WAS ACCOMPLISHED BY COOK ELECTRIC COMPANY RE-ENTRY RECOVERY PACKAGES.

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this region is open to more question. Current data indicates that the background radiation will not exceed the maximum dosage limits used by NASA in its studies. These limits, which are the standards used by the National Bureau of Standards, are 0.3 rem (roentgen equivalent man) per week, 5 rem per year and 25 rem total life.

Effect of solar flare radiation at all latitudes and altitudes has not been determined to date. Measurements made by balloon near the poles have shown that radiation bursts with fluxes up to 2 rem per hour have reached the vicinity of the earth following a solar flare.

Maximum intensity of these radiation bursts, or "storms," lasts about one day, and they increase the radiation in a given area for about a week to 10 days. Frequency of these "storms" is approximately 10 per year at the present time.

Solar radiation "storms" approximately 1,000 times more severe than the ones described above have been observed five times in the last 20 years.

Some authorities believe there is a good chance that a manned space station orbiting 300 mi. above the equator will be protected from all but the most severe solar radiation bursts by the Van Allen belts so that little or no shielding will be required to protect the crew. If future measurements show that this is not true and shielding is needed, the "storm cellar" approach is the most attractive means of providing it from a weight standpoint.

Storm Cellar

The storm cellar would be a small, heavy-walled sphere with a minimum living space inside to house the crew for several days after a solar flare. Since the radiation levels even in the Van Allen belts are well below the threshold of damage to most materials, the space station, its equipment and instrumentation will be undamaged by any radiation near the earth and the moon, and only the crew will have to be shielded.

Weight estimates for spherical storm cellars are so high, however, that there is serious doubt about the prospects of prolonged space travel by men in the foreseeable future. Studies by NASA contractors show that it will require at least a 30,000 lb. storm cellar to reduce the radiation from the most frequent type of relatively low-power solar flare to a safe level for humans. Such a storm cellar would have a spherical living space with approximately a 4-ft. radius. It would be quite an engineering accomplishment to provide this cellar with a life support system and internal arrangements to keep two or three men alive for a week or more during a radiation storm.

The great weight of the storm cellar would dictate that it serve as many functions as possible in any space vehicle which required it. Depending on the specific vehicle design, the cellar could double as a re-entry capsule and/or as a main structural element supporting dynamic, vibrating equipment.

NASA studies have shown that cellars with thick carbon walls lined internally with lead are effective radiation attenuators for their weight. Carbon stops the high energy solar protons and cosmic rays, and the lead stops the secondary radiation emanating from nuclear reactions between the carbon and protons. The heavy carbon walls are also a fine heat sink if the cellar must also serve as a re-entry capsule.

Radiation Hazards

Storm cellars required for human protection in the lower Van Allen belt and during a major solar radiation burst would dwarf the cellar described above. It will not be possible to consider sending vehicles with such components into space until very large nuclear rockets are available. The most encouraging aspect of the radiation picture is the fact that the present data is incomplete and in some cases contradictory. Most experts in the field believe that the current estimates of radiation levels in space will change considerably as more measurements are made. There seems to be no agreement, however, as to whether the change will be favorable for manned space flight.

The uncertainty of radiation conditions increases considerably beyond the Van Allen belts. Data returned from this area by satellites varies by several orders of magnitude concerning the level of background radiation. Some interpretations of this data are that an unshielded man would get his yearly radiation dose in two to three weeks, and others show that during an exposure of a year the man would receive only one half of the allowable dose.

Pessimistic View

If the pessimistic view proves correct, the total radiation level during a major solar flare would place the vehicle design and propulsion problem beyond present knowledge and materials.

Establishing the feasibility of manned flight to the moon within the next couple of decades appears to depend on a more definite knowledge of this area, better shielding materials and design and/or an accurate method of predicting solar flares.

Information on the occurrence of meteorites in space is sketchy, but based on what is available, scientists at NASA's Langley Research Center have estimated that a 40-ft. diameter, torus-shaped space station in a low orbit around the earth would be punctured at the rate of about once a month. The

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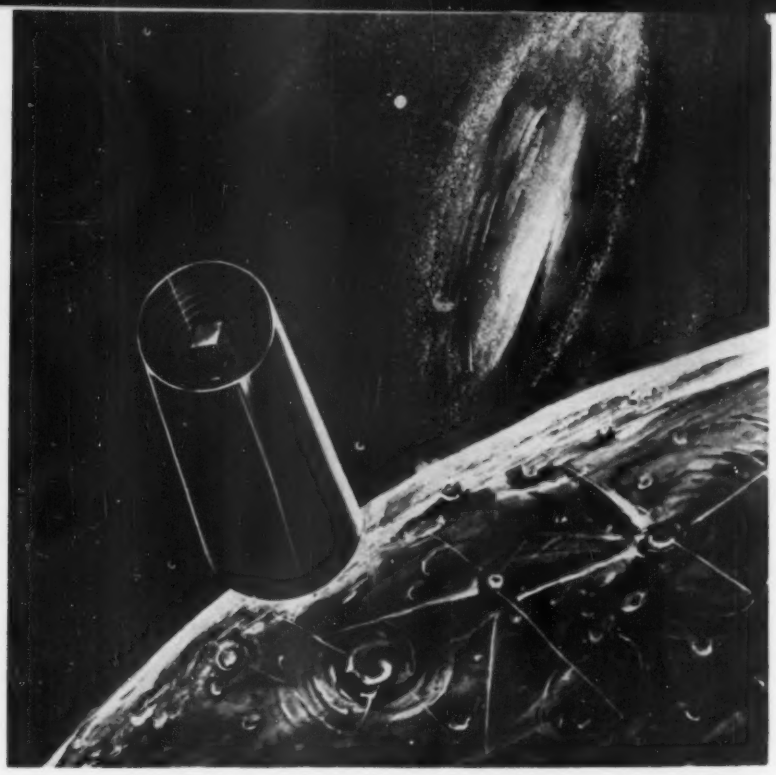


Power Unit Would Generate 300 kw. for Year

Two-loop nuclear space power conversion system using a saturated vapor Rankine cycle with output of 300 kw. for one year is shown in Garrett Corp. artist's conception. Radiator encloses a nuclear heat source, turbine and generator. System is being developed as part of Project Spur, which is under management of WADD and the Atomic Energy Commission. Potential output is expected to reach 1 megawatt.

holes would average one-sixteenth inch in diameter.

Theories on the effect of these penetrations of a space vehicle's structural materials vary widely. One idea is that at very high impact velocities, a small object will hit with explosive force and make a crater and cause damage similar to that inflicted by a much larger object traveling at a much slower speed. Catastrophic failure of pressurized vessels is known to have been caused by high speed projectiles. Other concepts reject this theory in the case of the space vehicle and some of the materials being considered for its structure.

Reconcile Differences

It appears to be impossible to reconcile these theoretical differences without improved experimental facilities on the ground or specially instrumented satellites. Current high-velocity "guns" used for this work are limited to a speed of about 20,000 fps., which is approximately the speed of sound in most of the materials of interest. It is believed that the character of cratering and impact changes radically when the impact velocity exceeds the speed of sound in the material.

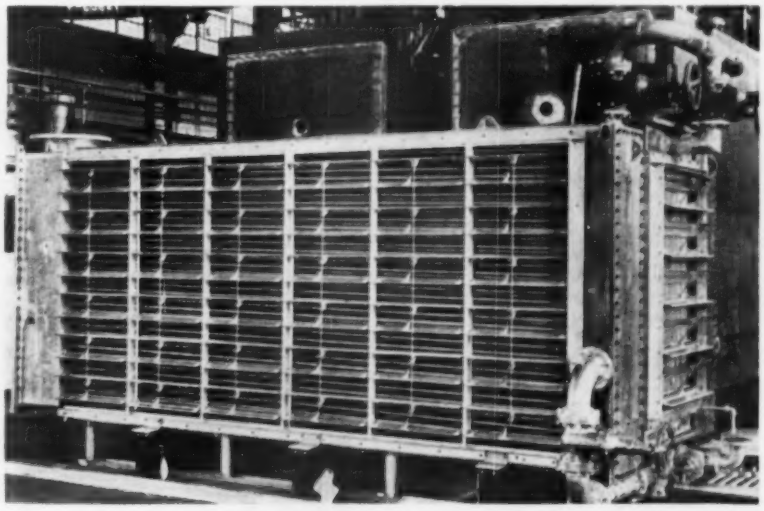
NASA's Research Advisory Committee on Structural Design has given a high priority to the development of an improved high-velocity "gun" and to the launching of a satellite which will catch some meteorites and return them to earth so their exact composition can be determined. These activities are believed to be essential to the development of realistic self-sealing and non-explosive space vehicle structure.

Total Environment

Solar ionizing radiation and meteorites are the major unknowns of the space environment, but there are other factors which will require extensive study and experimentation before they can be described properly in a detailed engineering specification. These factors are:

• **Hard vacuum**, which has a little understood deteriorating effect on the surface of most materials. In combination with certain types of radiation, a sputtering takes place on the surface of many metals that rapidly erodes them. When placed in contact in a hard vacuum, other metals will become welded together. Thermal resistance across joints is markedly different in a vacuum from what it is in the atmosphere, raising thermal stresses in structures. Fatigue problems probably will be increased in space because the damping action of the atmosphere will be absent to restrict vibration.

• **Thermal radiation** which will be experienced by a space vehicle is not well understood, even though the character



Portable Nuclear Powerplant Condenser Tested

Equipment for a prototype model of a portable nuclear powerplant is being built by Westinghouse Electric Corp. The nuclear powerplant is being developed by the Martin Co.'s Nuclear Division for Atomic Energy Commission. Photo shows a test model of a steam-to-air condenser 8 ft. x 8 ft. x 20 ft. long. Westinghouse has completed a feasibility study of a steam generator and secondary loop for the powerplant, and now is building the condenser, steam generator, turbine generator and switchgear. The Martin powerplant is designed for use at remote military installations. Westinghouse designed the condenser to operate from −60F to +125F. The three-phase, 60-cycle generator, which will power sensitive electronic equipment, will develop 4,160 v. within ±0.5% variation and ±0.25% frequency fluctuation under steady-state conditions. The system can be packaged in pods for possible airlifting purposes.

Sputnik Rocket Down

Washington—Final stage of the rocket vehicle that launched Sputnik IV into orbit last May 15 burned up in the earth's atmosphere over the Pacific Ocean on July 17, National Space Surveillance Control Center reported.

Sputnik IV itself and seven other objects still are in orbits with apogees ranging from 419.7 mi. down to 283 mi. and perigees ranging from 172.2 mi. to 181 mi. Periods range from 91.9 min. to 94.9 min. The satellite apparently broke in parts when Russia tried to separate the cabin from an instrument compartment (AW May 30, p. 35).

and intensity of solar electromagnetic radiation has been clearly established. The heating of a space vehicle will depend largely upon this solar radiation, but the effects of galactic radiation and the reradiated energy from the earth will also have an effect on the space vehicle's environment, and these factors currently are not well understood today.

- **Magnetic fields,** atmospheres and radiation fields surrounding other planets will have to be studied in detail before man can hope to travel in them.
- **Landing conditions** on the moon and the near planets will have to be firmly established before the current long-range goal of the national space effort—sending man to the near planets—can be accomplished.

Short Range Goal

One of the major short range goals of NASA is to completely define the environment of the earth and of space between the earth and Mars and Venus.

This is being done primarily through the research satellite program and by placing instrumentation in piggyback fashion in every payload that is sent into space that can accommodate a few extra pounds.

Some aspects of third generation space vehicle design are clear, even though their environment and design requirements are not fully known. One of the main features of these vehicles from a structural engineer's point of view is that they have to satisfy aerodynamic requirements for only a short period in their life. The vehicles must withstand high aerodynamic forces and dynamic loads during launch, and there is no real answer to this requirement except to build a dense, small frontal area structure which will not generate much lift. After this period, however, when the vehicle is in space, the structures expert has an unfamiliar freedom to shape it as he pleases and to arrange the heavy equipment in the vehicle so that he makes the best use of geometry and construction materials. From the work being done at present, it appears that this freedom for the structures man mean that third generation, large volume space structures will be flimsy and rickety in comparison with modern aircraft.

The conflicting requirements at launch and during operation in space have left only two alternatives to the space vehicle designer. They are to use:

- **Inflatable or collapsible** structures which can be compressed into a small volume during launch and then expanded in the vacuum of space.
- **Modular construction** so that a vehicle could be sent into space in many sections and assembled in orbit. Booster propellant tanks have been suggested as building blocks for such vehicles.

Relative Attractiveness

Relative attractiveness of these approaches depends to a large extent on booster reliability and size. Current opinion seems to be leading toward collapsible structures because a booster safe enough to carry men should be reliable enough to risk a large, expensive space vehicle. As booster payload capability reaches 15 tons and more, it becomes possible to think of sending complete space vehicles up in a single flight.

Construction Approaches

Importance of saving structural weight on space vehicles and the lack of aerodynamic restrictions probably will result in the use of simple geometric shapes. A sphere is the most efficient shape from the weight standpoint for a pressure vessel of given volume, construction material and internal pressure. A cylinder of torus is 1.3 times heavier than the sphere, and the weight goes up as the geometry is changed to accommodate any special vehicle design requirements.

If space vehicles are made of the high density materials common to aircraft, there will be a large weight penalty if the basic geometries mentioned above are modified seriously. However, the broad range of work with new structural materials and new thinking on the part of structural engineers has opened many

Snark Fired From Mobile Launcher

USAF-Northrop Snark intercontinental missile is fired from its mobile launcher at Cape Canaveral Missile Test Annex, Fla. Exhaust from the combined 260,000-lb. thrust of the booster rockets is deflected away from the launcher towing vehicle by canted rocket nozzles.

Chamber to Simulate Hypersonic Flight Environment

Environmental chamber for hypersonic research being built by Boeing Airplane Co. will simulate the noise, light, vibration, temperature and barometric pressure changes, and changes in the composition of gases which are expected to be encountered in hypersonic flight. Subject at left is about to be rolled into a small airtight chamber within a larger chamber. He will be given tasks as spotting targets on radar screen, handling simulated controls.

new possibilities in space vehicle design.

One of these new ideas concerns "isotensoid" structures which require the use of material that is stressed in only one direction. With normal solid type pressure vessel construction, the isotensoid construction is uneconomical because the material should be stressed equally in two directions as it is on a sphere to get maximum efficiency.

New Materials

New composite materials which resist a load in only one direction have made the isotensoid structure attractive. These materials have a low strength binder material reinforced with thin wires, whiskers and flat foils. Very thin gage metal elements a few microns in diameter or thickness have been found to have several times the allowable stress as the same metal rolled into the usual structural sheet. Objective with the composite materials is to take advantage of this strength. Recent tests have shown that the uni-axial tensile strength of composite materials which are practical for commercial production is well above the best strengths available with other forms of construction.

Design work by the Astro Research Corp. of Santa Barbara, Calif., has shown that isotensoid structures can be made into a wide variety of shapes to meet specific design requirements. If practical composite filamentary materials can be manufactured that have more than double the tensile strength of heavy gage metals, then isotensoid structures of any shape will be lighter for a given volume than a sphere made of sheet metal. If the strength of the isotensoid materials is increased, the sphere will not be the most efficient pressure vessel shape and will be joined by a whole range of new possibilities.

Structural specialists at NASA and elsewhere expect that the most important advances in space vehicle construction will come through judicious combination of new materials and new design concepts. This has proven true in many instances other than isotensoid pressure vessel design. Some of the urgent problems which are being attacked through close cooperation by structures and materials engineers are the following:

- **Development of improved structural** and insulation materials and designs for cyrogenic tanks.
- **Development of methods** for attaching point loads to large volume, thin wall pressure vessels.
- **Development of new configurations** of low density sandwich material made from commercially available gages of sheet metal.
- **Development of improved** means of stopping cracks in thin gage pressure vessels.
- **Development of multi-walled** pressure vessels capable of withstanding very high speed impact from small projectiles.

Japanese Launch First Kappa Rocket

Tokyo—First Kappa No. 8 two-stage rocket, carrying a 22 lb. payload, was successfully launched last month by Tokyo University's Institute of Industrial Science at Michikawa Beach, about 350 mi. northeast of here.

The 33 ft. rocket, weighing about 3,000 lb., reached an altitude of nearly 70 mi. Instruments telemetered information on fuselage temperature and operation of the rocket's tail fins. Powerplant produced about 20,000 lb. thrust.

The firing marked the first time a Japanese rocket reached the ionosphere after 69 similar tests since July, 1957; it was one of Japan's International Geophysical Year projects. Second Kappa No. 8 flight will measure electron density in the ionosphere.

Hypervelocity Tunnel To Test Dyna-Soar

Seattle—A hypervelocity wind tunnel scheduled to participate heavily in the development of Boeing's Dyna-Soar manned space glider and Minuteman ICBM programs has begun operation here.

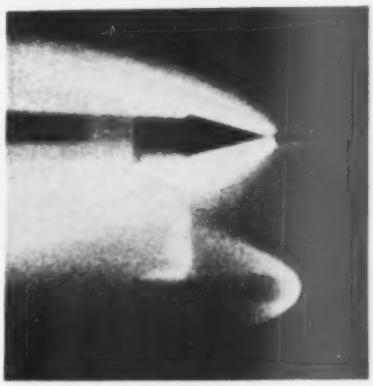
Operating in the speed ranges from Mach 10 to Mach 27, at temperatures up to 14,000F and simulating altitude conditions up to 260,000 ft., the electrical arc discharge wind tunnel will provide a research capability in regimes of space vehicle orbital speeds.

The 56-ft. conical steel tube tunnel's

BOEING HOTSHOT hypervelocity wind tunnel has two large circular windows on either side of its 44-in. test section. Usable test time is of about $\frac{1}{10}$-sec. duration.

test section measures 44 in. in diameter. A cooled and air-filtered room adjoins the tunnel, where electrical energy for delivering an impulse equivalent to 5 million hp. is built up and stored in 2,280 capacitors. Coaxial cables link each capacitor to a collector wheel to bring individual charges into a single conductor leading from the room into an arc chamber at the upstream end of the tunnel.

The stainless steel arc chamber is variable in size by use of insert plugs. Prior to a tunnel run, the chamber is charged with air under pressure to 2,000 psi., while the pressure in the test section is pumped down almost to a vacuum. The test section and the arc chamber are separated by a tungsten nozzle. Mach number of the test is controlled by varying the size of the nozzle opening, which ranges from 1/20-in. to ½-in. A thin plastic diaphragm between the nozzle and arc chamber maintains pressure differential between the arc chamber and the tunnel.

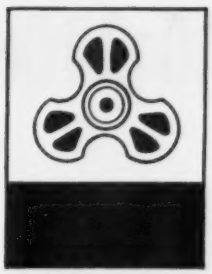


MACH 14 airflow transfers kinetic energy to heat and glows white-hot around pressure and heat transfer calibration model.

Space Particle Studies

Downey, Calif.—A hypervelocity impact gun has been developed by Aero-Space Laboratories of North American Aviation's Missiles Division to propel particles at a speed of 31,000 fps. Scientists participating in the program estimate that only 45% of the available energy of the system has been utilized and that greater speeds will be achieved when full available energies of the gun are used.

These experiments are being conducted under an Army Ordnance contract. Purpose of the program is to determine the effects of micrometeorite particle impact on spacecraft and satellites, and to learn what metal can be used most effectively for skins of these vehicles (AW July 4, p. 23).



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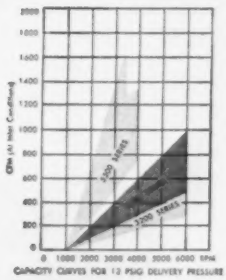

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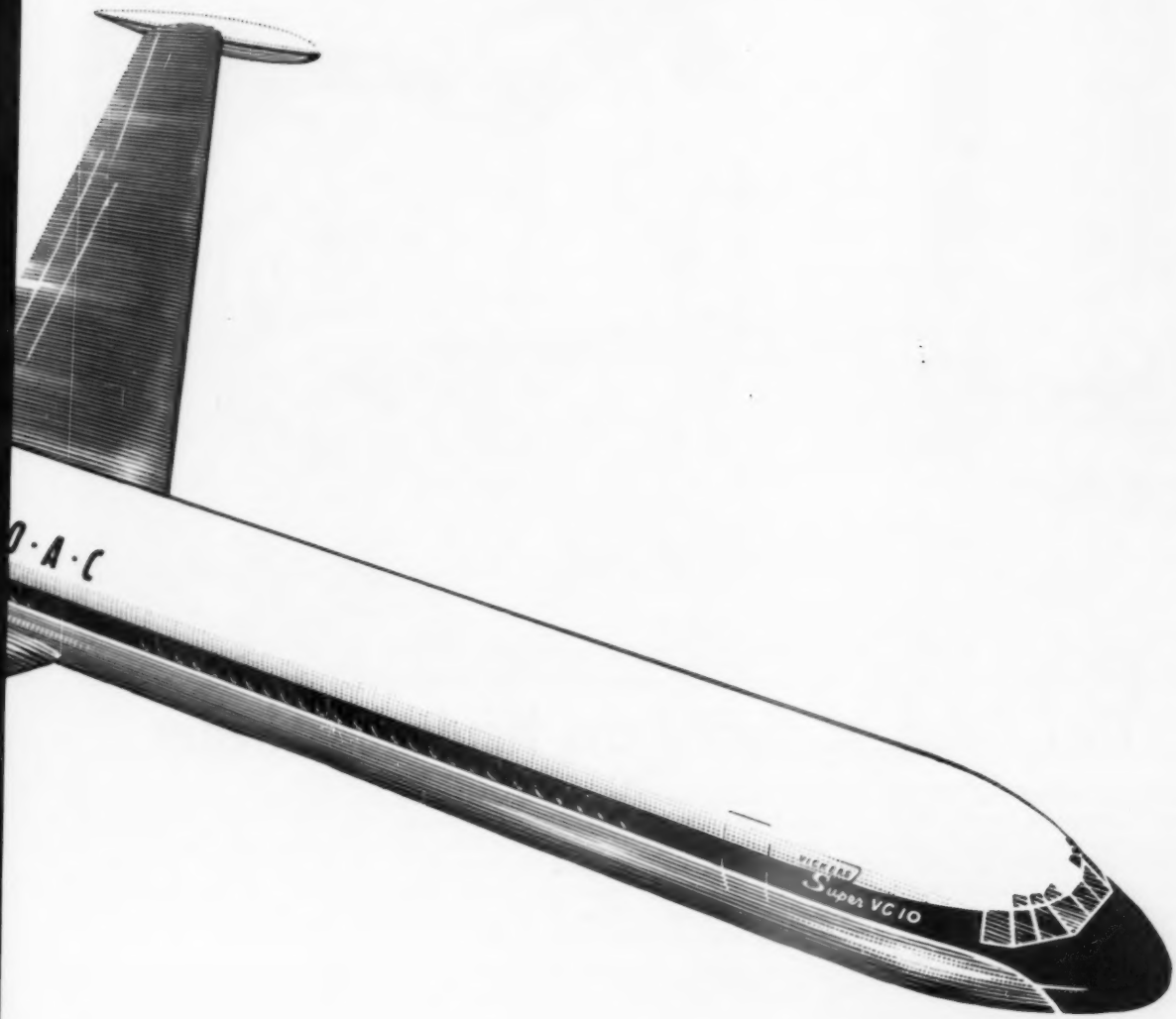

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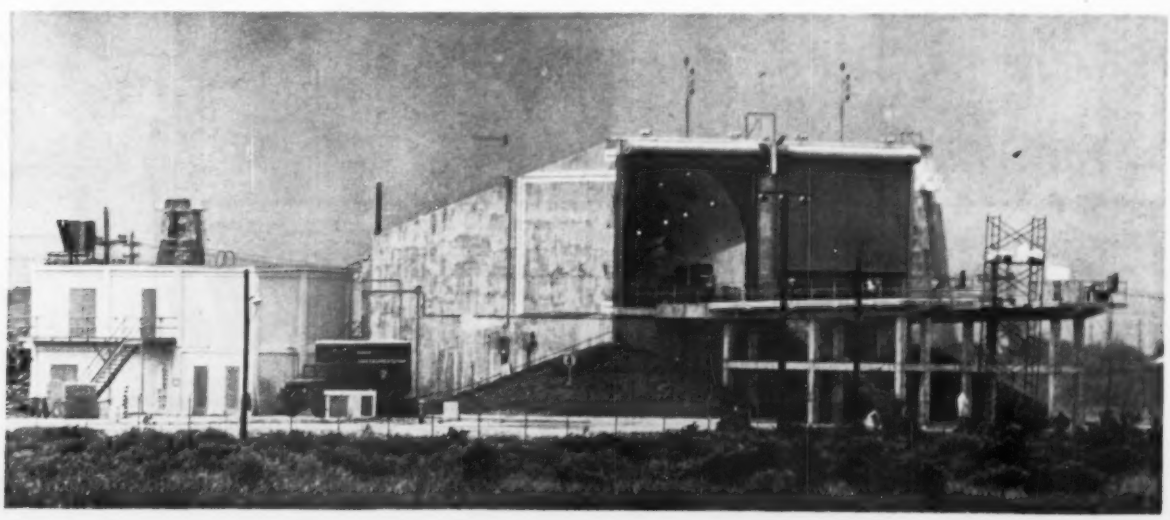
MISSILE ENGINEERING

First Firing of Mace From Hardened Shelter

USAF-Martin TM-76B Mace tactical missile is launched from simulated underground hard site at Cape Canaveral, Fla., in the first test of the concrete shelters and the first test to use production-type ground support equipment. In field use, launchers will be below-ground, multiple-cell installations. Mace was fired after a "hot hold," in which most of the extension checkout and countdown procedures are completed and missile is held in a ready condition, with only a brief final count needed for rapid reaction. Mace is inertially guided and is designed to remain in hot holds for as much as several days. New integrated missile checkout system, designed by Martin, was used. Prototype site at Canaveral is equipped to fire two missiles. Launching was the 14th for Mace B and the eighth since test program moved to Florida from Holloman AFB, N. M.



Robot Designed For Missile Retrieval

Washington—Vitro Laboratories is assembling a Solaris underwater robot system designed for missile retrieval and ocean research. The system is scheduled for delivery to the Navy in October.

Initial Solaris vehicle will be used to retrieve torpedoes at the Keyport, Wash., test range, but Vitro says the greatest potential in the system is salvage of spent rocket casings for reuse and recovery of nose cones. Solaris can pick up 8,000 lb. and perform a variety of salvage and observation missions.

Vitro now is assembling Solaris under a $140,000 contract awarded last September. Complete system weighs 500 lb. and will trail under a mother ship at depths to 2,000 ft. Supported by half-inch wire rope, it will use 25 kw. ship's generator to power its video scanner, sonar and electric motor. Control console on the ship has television receiver, depth and direction indicators.

Navy version will use retrieving claw manipulated by console operator. This working arrangement could be replaced by cable claw, stud gun, explosive magazine charge, magnet, grapple or movable lamps.

Dage videcon scanner is mounted in a pressurized housing surrounded by an array of three 500-watt lamps. In clear water, the camera can discern one-inch cable at 50 ft. In poor visibility, a target will be located by high resolution, low frequency sonar on claws near pivots.

Three-foot sphere above claws houses a 550-volt, 10 hp. industrial motor, driving two variable pitch propellers through a gear train. Screw pitch can be varied to provide a thrust range from 250 lb. positive to 200 lb. negative. While propellers are driven at constant 420 rpm., pitch variations permit the vehicle to go forward at 1.7 kt., hover or turn. System is 91.25 in. high, 53 in. wide aft and 65 in. long.

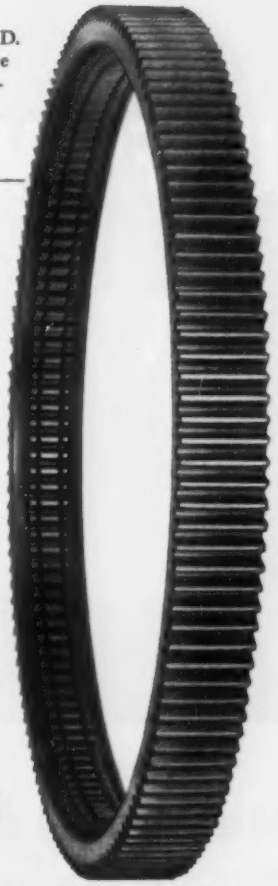
In addition to missile, nose cone and torpedo salvage, Vitro says Solaris can be used to retrieve underwater cables and sample ocean bottom.

Although the smaller boosters launched from Atlantic Missile Range have empty case weights exceeding Solaris' 4-ton capacity by a ton, Vitro says enlarging capacity is not limited by any difficult physical problems.

Convair Given Additional Contract for Army Mauler

Convair Division of General Dynamics has received an additional contract for $8,176,000 from the Army for continued development of the Mauler battlefield air defense missile system. Work on the program is being done at Convair's Pomona Division.

Snap-ring grooves in this 12" O. D. thin-section *Reduction Drive Gear* are machined before carborizing and hardening. Both spline and gear teeth are ground and held to .001" excentricity after hardening the entire gear.



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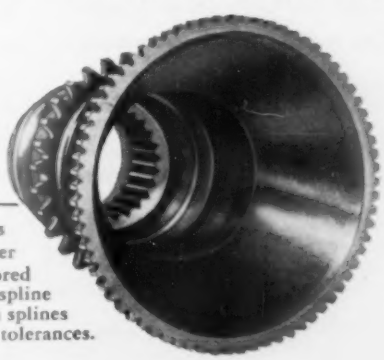

Most machining operations on this *Drive Gear Shaft* are performed after localized hardening with the cored areas at Rockwell C42. External spline and gear teeth are ground with splines held to precision tolerances.

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Concrete Cover Aids Radiation Tests

Mobile concrete lid, weighing 1,500,000 lb., helps to speed radiation effects tests in a pair of nuclear reactors at Convair Division of General Dynamics Corp., Ft. Worth, Tex. The cover prevents gamma rays and neutrons produced in the underground reactor from mixing with those from nearby aircraft shield test reactor.

Gulfstream Cleared For Weight Increase

New York—Grumman Aircraft Engineering Corp. has satisfield Federal Aviation Agency criteria for increasing maximum allowable gross weight on its Gulfstream twin turboprop executive transport by 1,500 lb.

Gulfstream owners, Grumman reports, may begin operating the transport at 35,100 lb., instead of the present 33,600 lb., "late this summer." Replacement of six knuckle pins in the plane's landing gear is the only modification required.

The takeoff weight increase will be accompanied by a 1,600 lb. boost in the Gulfstream's maximum landing weight, which will rise from 32,000 to 33,600 lb. Zero fuel weight of 21,600 lb. will remain unchanged.

The plane's maximum payload of 4,570 lb. (the difference between maximum zero fuel weight and operating weight) will be increased to 6,070 lb.

Grumman also may offer installation of two 150 gal. slipper-type fuel tanks outboard of the Gulfstream's nacelles. But this modification, which would give the transport a transcontinental capability, will be installed only if purchasers request it, Grumman said.

As of July 1, of the 46 Gulfstreams delivered by Grumman, 37 had been placed in operation by their purchasers.

The higher gross weight ceiling is of major significance to Gulfstream owners because it doubles the plane's passenger carrying capacity on long-range missions. Operating under the original gross weight, the Gulfstream, with a full fuel load of about 10,400 lb., had a top payload of approximately 1,300 lb.

This equaled about six passengers,

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Republic's F-105 Thunderchief, the Air Force's new Mach 2 tactical fighter, is able to nail targets on the head, night or day, cloudy or clear—even if the targets are hidden deep in rugged mountains.

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For more than a decade Autonetics has pioneered the way with monopulse radar systems like NASARR to provide America's pilots with a sixth sense.

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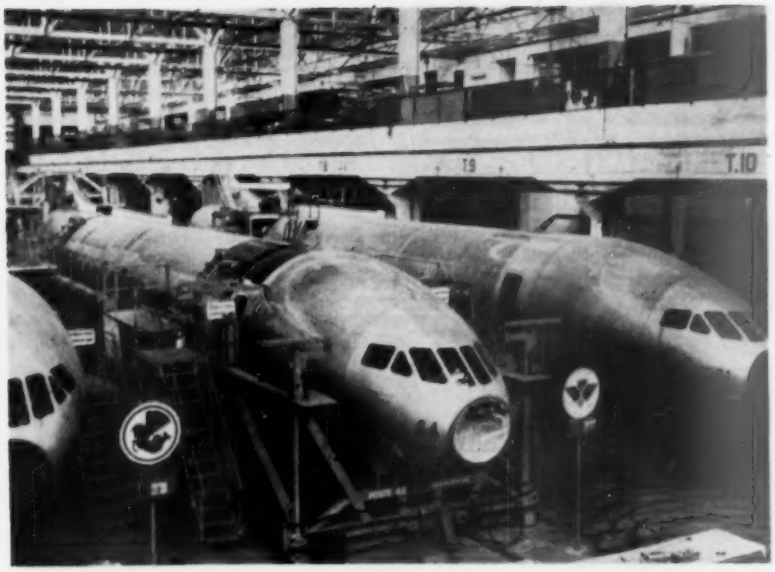


Sabena's First Caravelle VI Assembled

Fuselage of Sabena's first Caravelle VI, seen in the workshops of Sud Aviation at Toulouse-St. Martin, is assembled in three sections. Sabena has ordered four of the 70 passenger aircraft which cruise at 800 km./hr.

assuming an average passenger weight of 165 lb. plus 40 lb. of baggage. At its new gross weight, the Gulfstream can carry full fuel and up to 12 passengers, depending upon the interior configuration of the aircraft.

According to Grumman, the average fleet configuration provides seats for about 10 passengers, while the average Gulfstream flight carries 5.5 passengers.

PRODUCTION BRIEFING

Convair Division of General Dynamics, Fort Worth, Tex., is instituting a program to permit selected B-58 suppliers to inspect their own components, thus expediting shipments. The revocable award, based on proven quality control, will go first to Industrial Products Division of ITT, San Fernando, Calif., and Bendix Pacific, North Hollywood, Calif.

Sikorsky Aircraft, Stratford, Conn., will overhaul 30 Army H-37 helicopters under $3.5 million contract from the Army Transportation Materiel Command. Overhaul of the twin-engine helicopters includes installing automatic stabilization equipment and improving its aerodynamic efficiency.

Dalto Corp., Norwood, N. J., will produce two Dalto visual flight simulator attachments for the Navy under $149,000 contract. The visual devices, the second and third purchased by the Navy, will be attached to jet instrument trainers at Corpus Christi and Miramar, Calif., Naval Air Stations.

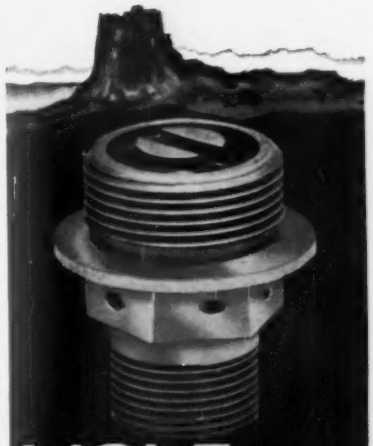
Institute of the Aeronautical Sciences council has voted to drop "Aeronautical" in the title and substitute "Aerospace," pending membership approval.

Lycoming fuel injection engine for use in the Aero Commander 500B executive twin and designated IO-540 (AW Apr. 11, p. 119) has been certificated at 290 hp. by Federal Aviation Agency. Commander Model 500A is powered by two 260 hp. IO-470 powerplants (see p. 148). New engine is a direct drive, six cylinder model; company will have a geared and a supercharged version available soon.

Royal Air Force has ordered 20 additional Armstrong-Whitworth AW 660 transport aircraft, making a total of 40 (AW Jan. 12, 1959, p. 37). Prototype AW 660—military version of the Argosy—is expected to make its first flight later this month. Armstrong-Whitworth also confirmed that Riddle Airlines will take delivery of five Argosies to start flights early next year, although the contract has not yet been signed. These aircraft will be used to fulfill Riddle's part of the Logair contract (AW July 4, p. 40). Loading systems and spares arrangements are under negotiation.

California Institute of Technology's Jet Propulsion Laboratory has closed its range facilities at White Sands Missile Range, N. M. The 19 people employed by JPL at the range have been transferred to JPL in Pasadena or to the JPL facility at Atlantic Missile Range, Cape Canaveral, Fla.

extra protection against in-flight engine failure



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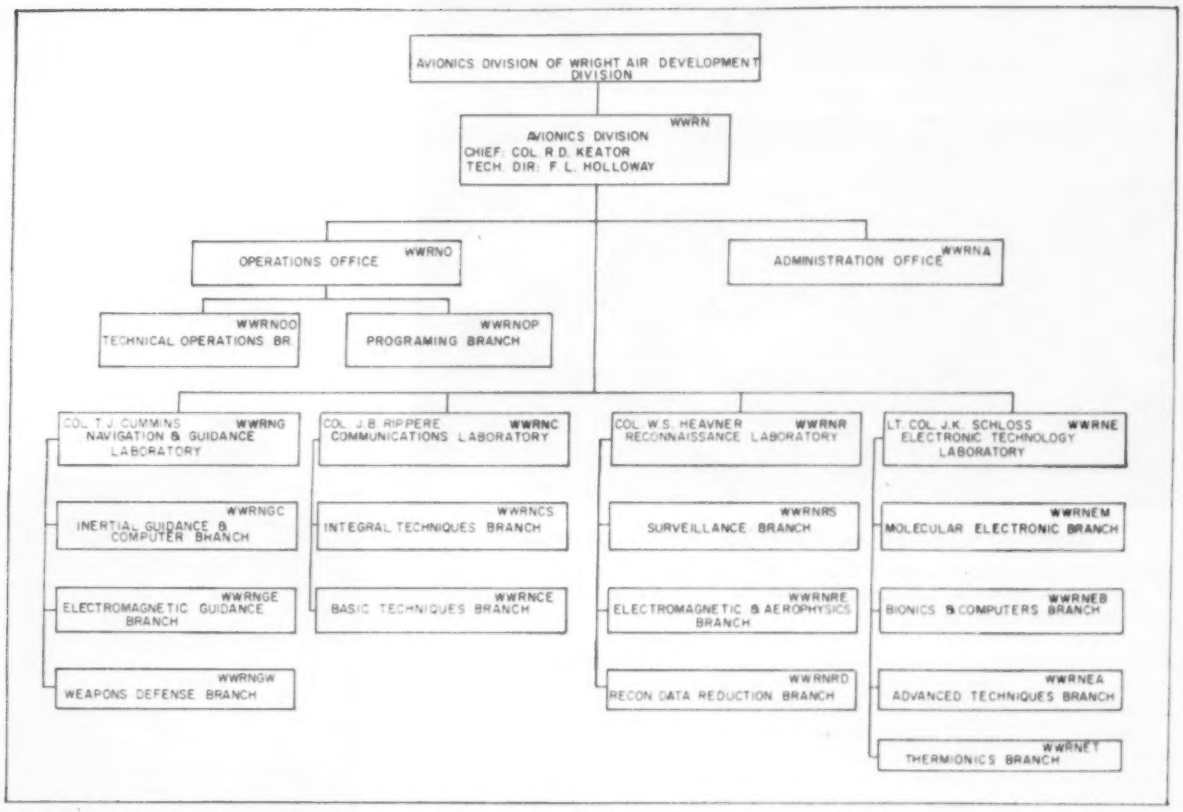


AVIONICS DIVISION, Wright Air Development Division, responsible for applied research, is divided into four major laboratories.

WADD Avionics Division Aims at Space

By Philip J. Klass

Dayton, Ohio—Newly formed Avionics Division of the Wright Air Development Division hopes to obtain nearly $50 million in Fiscal 1961 funds for applied research programs, the bulk of it for projects which are oriented toward space.

The Avionics Division, headed by Col. R. D. Keator, one of four divisions in the Directorate of Advanced Technology, is responsible for applied research as distinguished from hardware development for specific weapon systems. The latter is the responsibility of the newly formed Directorate of Systems Engineering (AW May 9, p. 27.)

Here, roughly, is how the Fiscal 1961 funds are expected to be divided among the Avionics Division's four laboratories:

- 35%: **Navigation & Guidance Laboratory.**
- 30%: **Reconnaissance Laboratory.**
- 20%: **Electronic Technology Laboratory.**
- 15%: **Communications Laboratory.**

There are approximately 450 persons now employed in the Avionics Division, of whom about 75% are engineers and scientists.

The separation of the former laboratory activities into two distinct functions—applied research here in the Avionics Division and hardware development in the Systems Engineering Directorate—has been easier for some of the laboratories than for others.

New Activities

For example, the Electronic Technology Laboratory, divorced from its former routine functions of component specifications and testing, is now free to concentrate on the new fields of molectronics and bionics. The latter is the application of the principles of living things to electronic design.

There is less enthusiasm over the reorganization in some of the other laboratories. For instance, there is concern that reconnaissance systems may suffer in priority and emphasis because of the new setup. Because Air Force has no vehicles, except for the Samos and Midas satellites, specifically designed for the sole mission of reconnaissance, reconnaissance equipment usually travels as a sort of hitch-hiker. There is concern that now, with hardware development under the direction of a weapon system engineer, in the Systems Engineering Directorate, who is responsible for many subsystems, the reconnaissance systems may suffer. Only time will tell whether this concern is justified or whether recent events have given reconnaissance sufficiently increased stature.

Unresolved questions over the Air Force's future mission in space, coupled with the fact that traditional weapons and missions are in a sharp state of flux, make it extremely difficult for many laboratories in the Directorate of Advanced Technology to plan their future programs.

Until several years ago it was relatively easy to extrapolate from present hardware and developments to future needs because only vehicle speeds and altitudes changed with time. The dawn of the space age changed all of this.

Because applied research must work five to 10 years ahead of hardware development, many of the laboratories must direct their efforts into "Buck Rogers" type prjoects.

The Avionics Division's Navigation & Guidance Laboratory, for example, already has studies under way on the problem of providing a defense for manned space vehicles against attempts to destroy them or alter their orbit/trajectory. Additional studies are planned with Fiscal 1961 funds. These are aimed primarily at attempting to define what the problem is, i.e. what sort of weapons or tactics are likely to be used by a satellite/space vehicle interceptor.

Since the U.S. is only starting to develop satellite interception/destruction techniques, and the Soviets presumably are in a similar stage, it is not easy to attempt to develop techniques for countering or defending against weapons which themselves are only in the fluid thinking stage.

However, there are certain basics which apply to any interception problem. For example, the satellite/space vehicle interceptor probably will use radar or infrared homing devices. Although radar countermeasures techniques developed for air-breathing vehicles probably can be readily adapted to space vehicles, countermeasures against infrared guidance in the space environment is a new problem, and one which the Navigation & Guidance Laboratory intends to explore.

Promising new techniques for inertial guidance components and star trackers, specifically suited for space vehicle use, also are of interest to the Laboratory, according to Col. T. J. Cummins, chief of the Navigation & Guidance Laboratory.

The bulk of this Laboratory's efforts are aimed at space applications, except in the field of electronic countermeasures where it will support applied research for air-breathing vehicles.

Reconnaissance Laboratory

The Reconnaissance Laboratory, under Col. W. S. Heavner, has broadened its former area of interest to include detection and identification of objects in space from both air-breathing and space vehicles, as well as surveillance of objects on the earth. The Laboratory plans an intensive program of applied research in sensors suitable for detection and reconnaissance, ranging from the ultraviolet and visible light end of the spectrum through infrared and radio/radar bands.

For example, major effort is intended to produce infrared detectors with greater sensitivity out at the longer infrared wavelengths (about 20 microns), where relatively cold objects have their peak infrared radiation, for use in detecting objects in space. Ultraviolet detectors also will receive increasing effort.

The Laboratory supports the Ballistic Missile Division's WS-117L Midas and Samos satellite programs. For example, one such current program is intended to investigate the "shimmering" produced by the earth's atmosphere, a phenomenon that causes stars to appear to twinkle when viewed from the earth, which sets a practical limit to the definition of earth-based objects that can be obtained from a reconnaissance satellite. One objective of this program is to establish practical limits for the size of satellite optics, consistent with limitations imposed by atmospheric shimmer.

Ferret Work

Reconnaissance Laboratory will continue its past work in electromagnetic reconnaissance, or ferret work. One current program will evaluate the use of extremely low-noise parametric amplifier in a ferret receiver.

Because antennas form a vital part of any ferret reconnaissance system, the Laboratory also plans applied research programs aimed at increasing the useable bandwidths of an antenna. Study program is under way on an antenna, suitable for use in a ferret satellite, which can be folded during launch and unfurled once vehicle is in orbit. Other antenna research areas include designs for use in hypersonic-speed vehicles where antenna and radome form an integral part of the vehicle structure and which employ electronic scanning techniques.

Reconnaissance Laboratory also has work under way in improved photomultiplier tubes with electronic control of contrast that makes it possible to view stars in daytime. Ultimate use of such devices could be to track satellites in daytime by reflected sunlight.

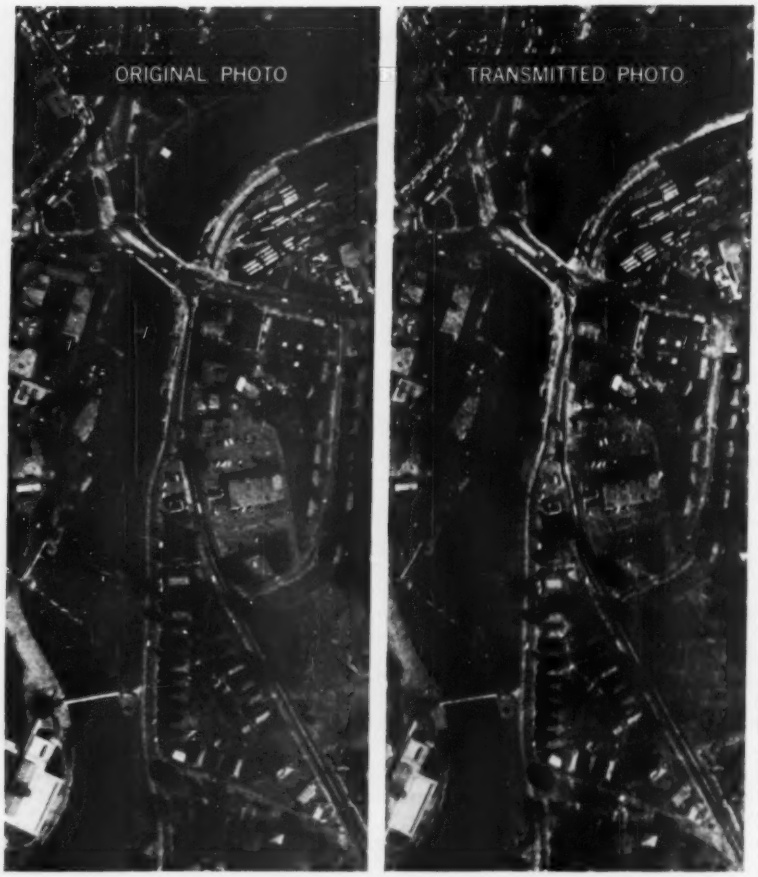
Because conventional photograph films employing silver halide are damaged by radiation from the Van Allen belts, or from nuclear explosions, the Laboratory is sponsoring work in other types of photographic recording medium, such as the recently announced General Electric thermal plastic recording (AW Jan. 18, p. 87). A number of companies are investigating non-silver halide photo recording techniques, according to Lt. Col. John Hansen, assistant chief of the Reconnaissance Laboratory.

Molectronics and bionics will represent major program areas for an Electronic Technology Laboratory, headed by Lt. Col. J. K. Schloss. Although interest is spurred by the size, weight, power and reliability requirements of space, molectronics and bionics programs are expected to pay off across the board, finding application in ground-based and airborne systems as well as space vehicles.

Fiscal 1961 funds will be used in part to support development of additional molectronic functional electronic blocks, called FEB's (pronounced "feebs"), beyond those under development by Westinghouse and Texas Instruments under WADD sponsorship. Laboratory also plans to put funds into

Reconnaissance Antennas Mounted on T-29B

Wingtip ferret receiver antennas, for electromagnetic reconnaissance, are new design under evaluation by engineers of International Telephone & Telegraph Corp. aboard this Air Force T-29B. Wingtip location provides full 360-degree coverage without blind spots.



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PHOTOSCAN, a radical advance in aerial reconnaissance technique, makes it possible to transmit visual information from manned or unmanned aireraft to ground receivers in seconds, without loss of detail.

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Challenging career opportunities are available at CBS LABORATORIES on long-range systems development programs such as PHOTOSCAN. Positions for physicists and electrical engineers are now open in the following departments: Military and Industrial Systems; Acoustics and Magnetics; Solid State Physics; and Vacuum Tube Physics.

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the development of techniques for interconnecting individual FEBs. Without a compatible interconnection technique, much of the size and weight saving of molectronic construction is lost.

Laboratory has study contracts now in the field of bionics. Fiscal 1961 funds probably will be used for further studies aimed at obtaining mathematical expressions which describe the operation of certain animal functions, then attempting to translate these into electronic equivalents, according to H. V. Noble, technical director of the laboratory.

Because of the close inter-relation of computer logic design and the capabilities of the basic elements used in the construction of a computer, the Electronic Technology Laboratory is expanding its efforts to include applied research in basic computer components and circuit logic, according to Col. Schloss.

Another relatively new area is basic research into plasma and its reactions with radio frequency energy, aimed at developing high power generators for millimeter waves. Laboratory also plans to carry out investigations in superconductivity and electronic applications for new materials. Relatively little financial support is planned for conventional component research because of extensive company-financed programs carried out by component manufacturers.

Communications Laboratory

The responsibilities of the Communications Laboratory, headed by Col. J. B. Rippere, encompass vehicle-to-ground, vehicle-to-vehicle, and internal vehicle communications, as well as advanced telemetry techniques. One of the more exotic programs now under way is to explore the use of modulated light for communications between vehicles and for vehicle-to-ground use (AW Dec. 14, 1959, p. 87).

There will be continued effort during the coming year in speech compression to reduce the power/bandwidth required for effective voice communications. This is particularly important for space vehicle use where only limited power is available. Laboratory programs also will aim at improved receiver sensitivity and lower noise figures.

Program to investigate techniques which will enable an antenna to simultaneously transmit on a number of different frequencies is in prospect for Fiscal 1961, according to Lt. Col. Robert A. McDaris, assistant chief of the Laboratory. Communications Laboratory also has program to develop small headset radio intercommunications system which will permit direct communications between crew members of an aero/space vehicle without encumbrance of present wired intercom system.

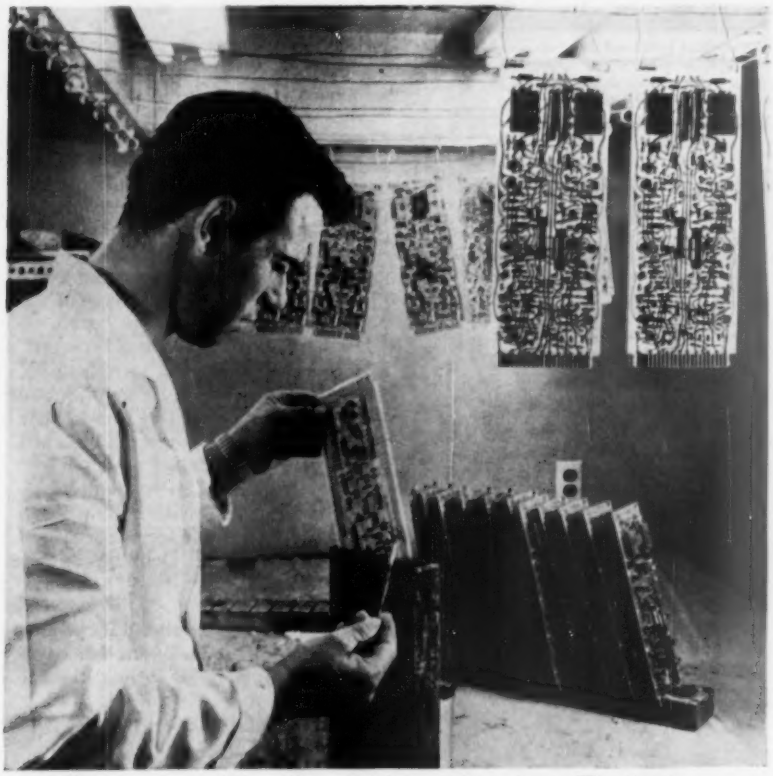
FILTER CENTER

▶ **Transistor Bloom May Be Fading**—Straws in the wind suggest that semiconductor industry may be approaching shakedown period which will thin its ranks. One indication is the rash of price cutting on transistors. Another is the fact that transistor sales for April were up only 68% over previous year. This is a respectable increase but for the fact that the semiconductor industry unit sales have been doubling each year. Situation results from influx of many new companies into the field, major facilities expansion by older manufacturers and the fact that fewer Defense Department dollars are going into large-scale production programs. Japanese semiconductor industry also reportedly is worried over growing inventories of transistors.

▶ **Melpar to Study Molectronic Trends**—Melpar will study airborne avionics equipment to determine future requirements for molectronic developments under Wright Air Development Division contract. Company will study existing and proposed equipments to determine frequency, distribution, similarities and characteristics of equipments and circuit functions.

▶ **Galactic Noise Navigation Studied**—Ewen Knight Corp., East Natick, Mass., will measure spectral characteristics of 24 kmc. ammonia line radiation from galactic radio sources to explore its possible use for space navigation and guidance under $33,000 contract from Wright Air Development Division.

▶ **GE Designs Welded-Wire Matrix Machine**—Machine which can fabricate welded-wire module matrices (AW Aug. 24, 1959, p. 104), under command of a tape program prepared automatically by computer, is being developed by General Electric's Light Military Electronic Department. The machine, slated to be ready in September, will be able to produce 30 ft. of welded-wire matrix ribbon per hour. Using computer to design optimum matrix layout, and machine to produce it, GE estimates that it will eventually be able to produce a welded wire matrix within 90 min. after circuit design has been fixed. Life tests on welded module assemblies,



Librascope Develops New Potting Technique

New potting and protection coating techniques for complete computer subassemblies, developed by Librascope Division of General Precision, Inc., are shown being applied to the printed circuit boards, called "logic cards," which comprise the intelligence of electronic digital computers. Process protects against humidity, contamination, shock, vibration.

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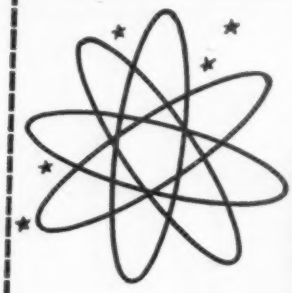

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PROBLEMATICAL RECREATIONS 25

L makes 5 scarves while M makes 2; Z makes 4, while L makes 3. Five scarves of Z's weigh one of L's; 5 of M's weigh 3 of Z's. One of M's is as warm as 4 of Z's, and one of L's as warm as 3 of M's. Which is best, giving equal weight in the result of rapidity of work, lightness, and warmth? —*Charles Lutwidge Dodgson*

Among the products of our Maryland Division are telemetry systems. For the record, a Maryland Division telemetry system was used to track the first missile nose cone that successfully re-entered earth's atmosphere.

ANSWER TO LAST WEEK'S PROBLEM: He lost, even if they played only twice, or four times, or six, or . . .

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New Simulator

Radar augmenter and doppler simulator, developed by Emerson Electric, St. Louis, simulates 30 sq. meter target at X-band with 45 x 20 degree coverage in pulse operation on 100 sq. meter target with omnidirectional coverage for CW operation. Comparable performance is available at other bands. Device also provides simulated doppler output, with frequency shift of 10 cps. to over 1,000 kc. Bandwidth is ±20 mc. from center, with tuning over a 10% band.

containing 23,000 welded joints and 5,000 soldered joints, subjected to simultaneous vibration and thermal cycling, experienced not a single joint failure in 600 hr. of testing, company reports.

▶ **Computer Does Double Duty**—Digital computer developed by North American's Autonetics Division for airborne guidance of the GAM-77 (Hound Dog) air-to-surface missile, will also be used on the ground for automatic calibration and checkout of the missile's entire inertial auto-navigator.

▶ **AIEE Goes Into Orbit**—Four days of technical sessions dealing with space technology, with particular emphasis on exotic power sources and electric propulsion systems, will be a feature of the Pacific General Meeting of American Institute of Electrical Engineers. Sessions are sponsored by the Aero Space Transportation Committee of the AIEE.

▶ **How to Keep Cool**—"Handbook of Methods of Cooling Air Force Ground Electronic Equipment" is title of new 600-page report prepared by Cornell Aeronautical Laboratory under Rome Air Development Center sponsorship. Copy, identified PB-161264, can be obtained for $8 from Office of Technical Services, Commerce Dept., Washington 25, D. C.

▶ **Signed On the Dotted Line**—Major contract awards recently announced by avionics manufacturers include the following:

• **Collins Radio,** Cedar Rapids, $1.2 million Air Force contract for additional single sideband radio communication equipment for Strategic Air Command.

• **Melpar, Inc.,** Alexandria, Va., will produce target detecting devices for

Navy Bureau of Weapons under $1.4 million contract. Company also reports contract to develop warning and detection systems for Army Chemical Center.

• **Servonics, Inc.**, Alexandria, Va., will develop and build radar system simulators under a letter of intent awarded by Navy Bureau of Ships.

NEW AVIONIC PRODUCTS

• **Transducers**, Models 10-R-60-1 and 10-R-30-1, offer 0.2 v. rms./deg. and 0.4 v. rms./deg. sensitivity, respectively. They are cylindrical units, 1.25 in. high and 0.937 in. in diameter. These transducers are available with a.c. input and a.c. or d.c. output. Typical specs for size 10 linear-motion a.c. to a.c.

transducer are: input range– ±30 deg. and ±60 deg.; input voltage–26 v.a.c., 400 cps.; output impedance–5,000 ohms; independent linearity– –0.3%; null (tuned)–0.1% of full scale; usable frequency range–300 to 3,000 cps. Arnoux Corp., 11924 W. Washington Blvd., Los Angeles 66, Calif.

• **Bistable multivibrators** which occupy 0.35 cu. in. and weigh only nine grams have been designed for digital computer applications and are available in seven-pin base packages. Frequency response of units ranges from d.c. to 10 mc. and operates from 12 v. supply. Multivibrators will operate satisfactorily over –55 to 55C range. Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

• **Tunnel diode** price/spec graph enables an engineer to select tunnel diodes with peak current, peak current tolerance and peak to valley ratio he desires and from these selections easily determine selling prices for diodes he specifies. Sperry Semiconductor Division, Sperry Rand Corp., South Norwalk, Conn.

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Marquardt Plans to Diversify to Survive

By Michael Yaffee

Columbus, Ohio—Faced with the approaching completion of the Bomarc engine program, Marquardt Corp. is fighting for corporate survival by aggressive moves into the electronics and space fields to tide over the critical years.

This is the view of Roy E. Marquardt, corporation president, who told AVIATION WEEK his company has a number of promising projects under study but added "the big question is whether there will be time to bring them to fruition."

The alternative, which Marquardt apparently is attempting to avoid as long as possible, is selling the company to one of the airframe or engine firms that have been knocking on its corporate door.

Marquardt took an optimistic view of the ramjet's role in propulsion during the next decade and beyond. He discussed such things as the company's hyperjet (AW Aug. 10, 1959, p. 30), its potentials as a large space booster and as a main powerplant for an area defense anti-ICBM missile, and the company's new nitrogen-burning ramjet that might be developed for use on Mars.

In a discussion of Marquardt's present plans and problems, Marquardt said the next few years admittedly are going to be critical ones in the life of the corporation.

Basically, Marquardt's problem now is the same one that has been plaguing the company almost from its inception, that of filling an ever-widening gap left by the cancellation or completion of the company's major project—the Bomarc missile engine. Starting off in a small way, Marquardt has been what amounts essentially to a one-program company. So far, each time Marquardt's prime payoff program has ended, its place has been taken by a somewhat bigger program.

Diversification Moves

At the same time, the potential of financial disaster has loomed ever larger and more threatening if that gap was not filled. Too, as the number of government programs grows smaller and each program becomes individually larger and more complex, it is more difficult for a comparatively small independent company such as Marquardt to get one of these projects. Given the time, Marquardt hopes to remedy this situation by further diversification into the electronics and the consumer market.

At the heart of Marquardt's current difficulties is the pending loss of the Bomarc engine program which is scheduled to end production in the second half of 1962. This has been and still is the company's most important project. This year, Marquardt's Ogden, Utah, plant has engaged in a major changeover effort, phasing out production of the Bomarc-A model and phasing in the B model, and so has avoided taking on any new business. The company also has been heavily occupied with the development of an advanced, boron-fueled Bomarc. But this work is now being completed and, at least it now appears, there will be no more Bomarcs after 1962.

As for the troubles encountered by the Bomarc-B in the early part of its flight evaluation program, Marquardt readily takes full responsibility. At least four of the first five flight failures were due to malfunctions in the vehicle's ramjet propulsion system, Marquardt said. Marquardt also conferred recently with North American Aviation's Columbus Division on the ramjet engine it will be making for NAA's new Redhead (high altitude) and Roadrunner (low altitude) drones (AW July 4, p. 37). The same ramjet engine will be used in both versions of the drone. It will be a new engine, considerably smaller than the Bomarc powerplants. Marquardt considers it a good program but not big enough in itself to fill the sizable gap that will be left by the phaseout of the Bomarc project.

Electronics Venture

Marquardt's venture into electronics now is beginning to pay off and may help carry the company over the next few critical years. This year, electronics will account for an estimated 10% of sales, but until just recently it has looked as though it were going to prove more of a bane than a blessing.

When the company bought American Machine and Foundry's trainer simulator activity a year and a half ago, it was losing money, according to Marquardt. The company sustained a particularly heavy loss in the development of the T-4 simulator for use in training air defense ground command personnel. However, this trouble now is behind it, Marquardt said, and the company has just received a major new contract for simulators to train aircraft personnel in the launching of Hound Dog and Quail missiles. There also are two other major training simulator programs that the company hopes to obtain in the next month or two.

For the commercial market, Marquardt is doing a variety of work on instrumentation and test equipment. Most of this work, however, is still in the development stage. The only equipment the company is actually selling now is a high temperature materials test unit. But even taken as a whole, Marquardt considers the potential of the company's current electronic activities comparatively limited.

The projects with real potential, as far as Marquardt is concerned are Slam and Pluto (AW June 20, p. 206). If these projects were to lead to a weapon system program, it could amount to a lot more than a chance for survival and a replacement for Bomarc. The nuclear-powered ramjet still presents some formidable development problems, including materials, says Marquardt. But he is confident these will be overcome.

Ramjet Range

The nuclear-powered ramjet engine, Marquardt believes, is potentially an attractive way of propelling a missile with a heavy warhead at high supersonic speeds and low altitudes. It holds the promise of infinite range, maneuverability and the possibility of recall. In combination with an ICBM force, he says, it makes a good offensive system that could force the enemy into an extensive and costly development of new defensive systems. Beyond the weapon system role, Marquardt sees the possibility of transporting cargo by nuclear ramjets. The transportation of humans by this means does not appear as attractive due to the shielding problems, which would be approximately the same as those anticipated in a nuclear-powered rocket.

For the past few years, Marquardt has been working with Air Force contract support on the development of large space boosters. Of the several approaches to the problem now under study, the company will talk only about the hyperjet. Essentially a perturbation of the ramjet cycle, the hyperjet is a ramjet engine that can be closed off at one end to function as a rocket when required. Originally, it was considered as a powerplant for an advanced Bomarc that would not have to use boosters to get off the ground. For this reason among others, it has also been suggested for use in a supersonic transport.

In large space booster applications for

such missions as setting up manned space stations, according to Marquardt calculations, even the first relatively primitive hyperjets will save up to 50% of the costs now estimated for these boosters. More sophisticated hyperjets might save up to 90% of the estimated costs. The advantage of the hyperjet as a powerplant for an anti-ICBM weapon lies in its ramjet cruise capability. Combined with an adequate early warning capability, it is suggested, this would enable the missile to cruise out to the area of anticipated ICBM penetration where it would convert to a rocket prior to its attack. Some airframe companies reportedly have used the hyperjet engine as the basis for proposals on area defense anti-ICBM missiles to supplement the point defense Nike Zeus.

Hybrid Engine

On its own, Marquardt is working on the development of a hybrid (solid fuel) liquid oxidizer rocket engine primarily for ballistic missile booster applications. Grand Central Rocket is supplying the solid fuel grain for this work. Company work to date indicates that such an engine will offer specific impulses at least equivalent to liquid oxygen-JP combinations, up to 100% throttlability, stable combustion and good storage characteristics since fuel and oxidizer are stored separately.

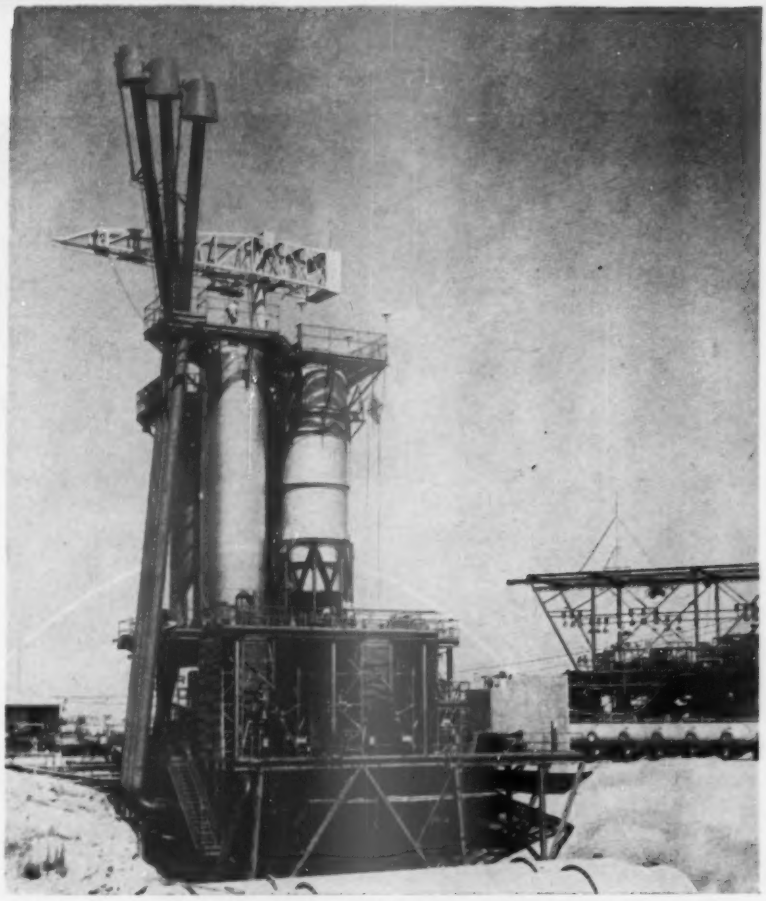
Another Marquardt project is PAT-C (position, attitude, trajectory-control), essentially a vernier rocket system to be used in stabilization and control which reportedly achieves unusually high performance efficiency.

From a long range point of view, one of Marquardt's most interesting projects is its Martian ramjet which would be able to operate in Mar's nitrogen atmosphere. The company has already run tests, Marquardt said, with ramjet engines using fuels that actually release heat when combined with nitrogen. Marquardt also is carrying out studies on electrical propulsion techniques based on linear accelerators, and on the production of electrical power from solar and nuclear energy sources.

Highly Promising

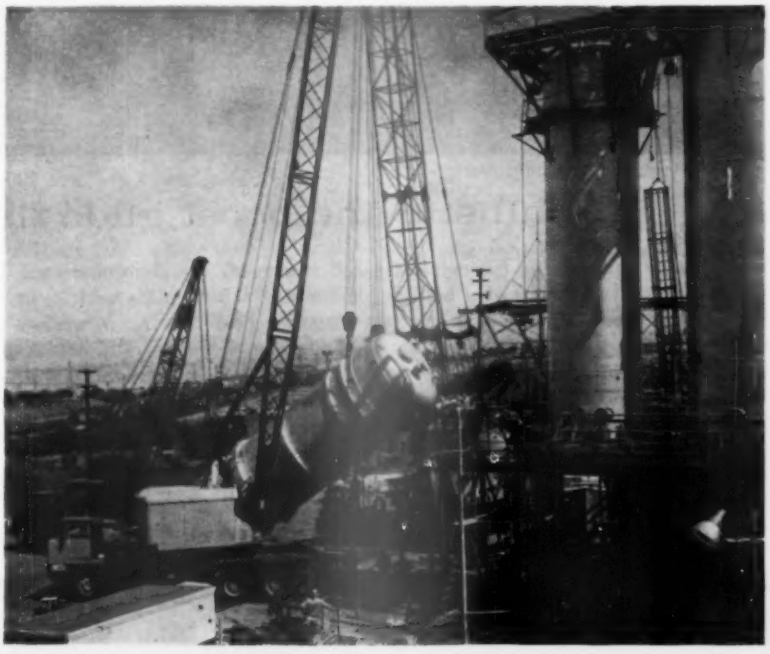
Many of these projects are considered highly promising, but they all require time to reach the payoff side of the ledger and nobody is sure just how much time Marquardt has. Roy Marquardt wants to see the company keep its corporate identity, bring its products to market and diversify through in-house developments and acquisition. But Marquardt has stockholders and a board of directors to answer to, and other wealthier companies have been pursuing Marquardt with attractive acquisition proposals.

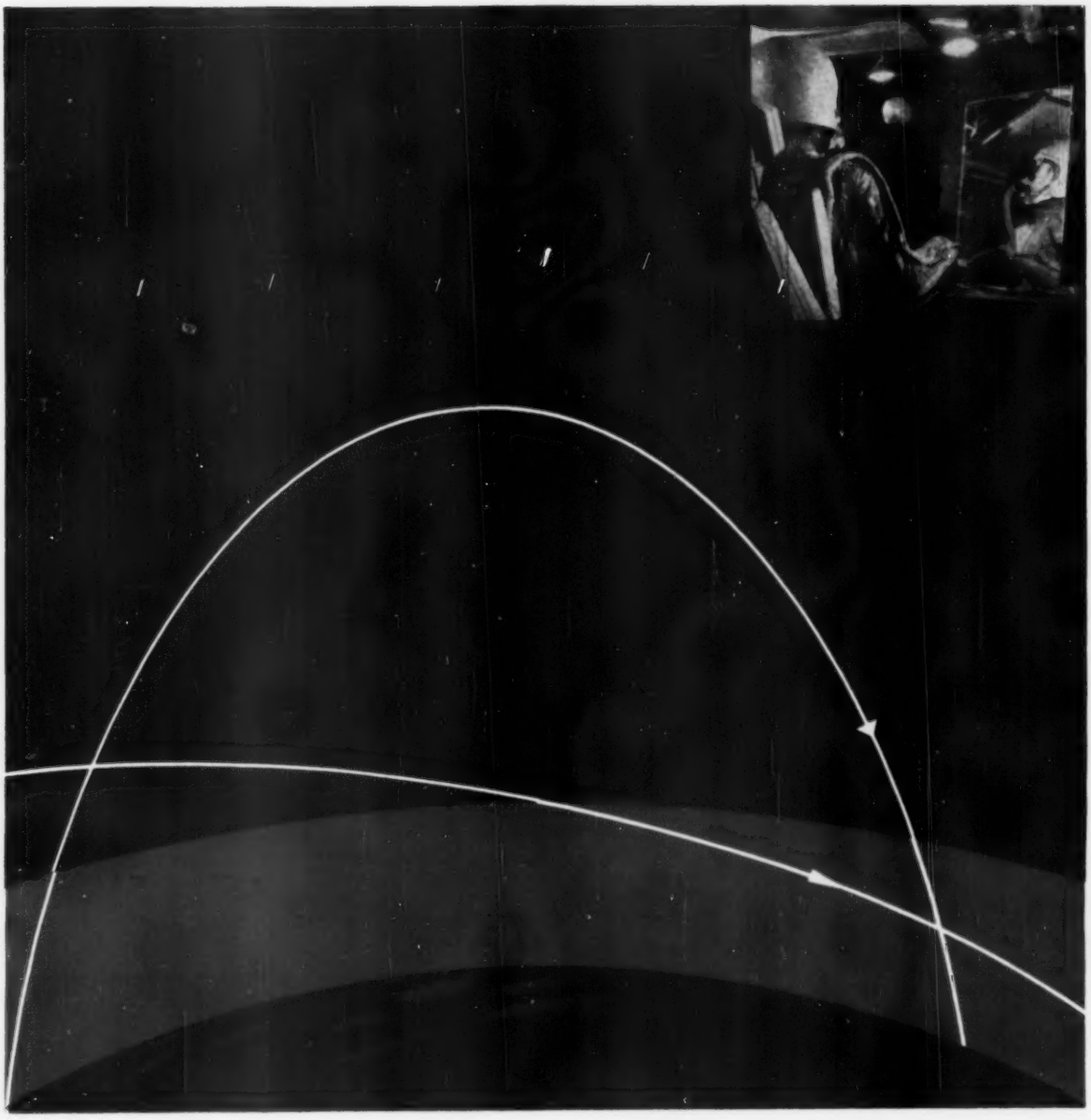
General Electric and United Air-



Rocketdyne Facility Will Test F-1 Turbopumps

Stand at North American's Rocketdyne Propulsion Field Laboratory, Canoga Park, Calif., will test turbopumps of National Aeronautics and Space Administration's F-1 1.5 million lb. thrust space booster. Two 20,000-gal. liquid oxygen tanks, a 30,000-gal. fuel tank and a 20,000-gal. water tank have been installed on the stand (above). Gas generator exhaust is ducted upward through tilted pipes at left, above, and is ignited by afterburners on top of exhaust pipes. Turbopumps, to be tested later this year, will deliver 6,000 lb. of propellant a second into the F-1 combustion chamber. Below, a 53-ton liquid oxygen vessel is being raised to the test stand.





Ballistic and boost-glide flight paths

These flight paths, arcing through space and re-entering the atmosphere, are characteristic of the paths of a ballistic missile and a boost-glide vehicle. In both areas, Boeing holds major contract responsibilities. Boeing is weapon system integrator for the solid-fuel ICBM, Minuteman, and as part of a USAF-NASA research program, is developing Dyna-Soar to study the problems of manned space flight. The Dyna-Soar vehicle will be capable of re-entering the atmosphere and making a normal controlled landing.

Boeing scientists and engineers, in addition, are advancing the state of the art in many areas: advanced military and commercial aircraft, hypersonic flight, space crew environments, vertical and short take-off and landing aircraft, gas turbine engines, anti-submarine warfare systems, among others.

Professional-Level Openings

These and other future-oriented programs at Boeing offer outstanding career openings to professional specialists in the scientific and engineering disciplines, as well as in a broad spectrum of company activities in other-than-engineering areas. You'll find at Boeing a professional environment conducive to deeply rewarding achievement. Drop a note, now, to Mr. John C. Sanders, Professional Personnel Administrator, Dept. ANI, Boeing Airplane Company, P. O. Box 3822, Seattle 24, Wash.

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craft's Pratt & Whitney Division were the first groups to express an interest in acquiring the Marquardt Corp. Last year Thiokol engaged in merger negotiations with the company. At that time Marquardt was in the rather unusual position of being able to give Thiokol two things it very much wanted—Roy Marquardt himself, with the experience and qualifications to succeed Thiokol President J. W. Crosby, who wants to retire, and a going nuclear propulsion capability.

No Agreement

Negotiations finally were called off with an official explanation that the two companies couldn't agree on terms of the stock exchange. However, although neither group will officially comment on the matter now, the real reason for the break in negotiations is believed to have been Roy Marquardt's insistence on taking several of his top people along with him into Thiokol management echelons, already filled with young executives.

The company most recently reported to be showing an active, though not yet direct, interest in acquiring Marquardt Corp. is Lockheed Aircraft.

Lockheed's planning department, according to informed industry sources, has been engaged in carrying out a study on Marquardt.

New Offerings

The Garrett Corp., Los Angeles, Calif., engaged in the manufacture of aircraft and missile component systems. Offering is 100,000 shares of common stock for public sale at $46.00 per share. Of the proceeds, substantially all will be used to reduce the current bank borrowings.

Infrared Industries, Inc., Waltham, Mass., engaged in the manufacture and sale of infrared detectors for infrared systems under procurement by the U.S. armed forces. Offering is 135,000 shares of common stock for public sale, the offering price and underwriting terms to be supplied by amendment; of the shares, 100,000 are to be offered for the account of the company, and 35,000 by the holders thereof. Of the proceeds approximately $450,000 will be applied to the discharge of indebtedness of the company and that of a subsidiary; the balance for working capital and other purposes.

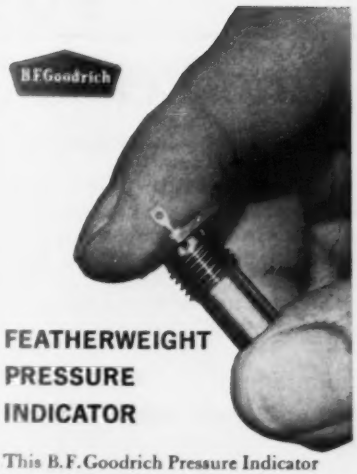
Yardney Electric Corp., New York, N. Y., principally engaged in the development, design, manufacture and sale of silver-zinc primary and rechargeable batteries under the trademark Silvercel and of silver-cadmium rechargeable batteries under the trademark Silcad. Offering is 254,000 outstanding shares of common stock for public sale by the holders thereof; offering price and underwriting terms to be supplied by amendment.

Avionics Investing Corp., Washington, D. C., a closed-end, non-diversified management investment company to provide equity capital and long-term loans to small business concerns engaged in research, development, scientific applications and manufacture of chemical and other products or devices used in the general field of aviation and missiles. Offering is 400,000 shares of capital stock for public sale at $10.00 per share. Proceeds will be used for investment in small business concerns in amounts up to $800,000 for a single concern.

Varian Associates, Palo Alto, Calif., has fixed a price of $44 per share for its proposed offering of 216,645 shares of capital stock for subscription by stockholders of record July 14, 1960, at the rate of one new share for each 15 shares then held.

Astrex, Inc., New York, N. Y., organized under New York law in June, 1960, to acquire all of the outstanding stock of AST Co., Inc., and Dutrex Industries, Inc.; AST Co. is engaged in the business of distributing industrial and special purpose electronic tubes, flight instruments, electronic components, precision ball bearings and certain miscellaneous equipment used principally in the electronics, aircraft and missile industries; Dutrex is the exclusive merchandising source and supply agency for receiving tubes and television picture tubes marketed under the brand name DuMont. Offering is 100,000 shares of common stock for public sale at $4.00 per share. Of the proceeds, $43,500 will be used to pay the first installment of the purchase price of 51,750 shares of AST common stock to be acquired from Barney Barnett; $15,000 to repay a loan from Morris Kass, a director and principal stockholder; $168,000 to repay secured bank loans to Dutrex; $25,000 to relocate the operations of AST Co.; $10,000 for advertising; $61,000 will be added to working capital and to be used for corporate purposes.

Aircraft Dynamics International Corp., New York, N. Y., engaged in the selling of aircraft parts, supplies, and equipment to major domestic and foreign airlines, foreign governments, and aircraft overhaul and maintenance facilities. Offering is 99,000 shares of common stock for public sale at $3.00 per share; this is the first public offering of common stock. Proceeds will be used to expand inventory and to eliminate a working capital deficit.



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Time-Lease Firms Spur Business Travel

By Herbert J. Coleman

Nationwide utilization of twin-engine business aircraft leased to corporations on a guaranteed-use time basis is being spurred by two new companies which will supply aircraft, pilots and services.

The firms are Air Time Leasing Division of Aero-Industries, Inc., of Miami, Fla., and Private Air Travel, Inc., of Erie, Pa. Air Time Leasing has seven aircraft and 12 on order and Private Air Travel currently is sounding out corporations on potential contracts before purchasing "up to 100 planes."

Air Time Leasing Division now concentrates its operations in the South, but plans national operations in another year. Private Air Travel initially will operate in the northeast portion of the U. S., then gradually expand throughout the country.

Umbaugh-18 Flies With New V-Tail

First flight photo of the Umbaugh-18 autogyro shows configuration with new V-tail installed, which company says adds to stability and facilitates production at Fairchild Engine & Airplane Corp.'s Hagerstown plant (AW June 27, p. 86). Previous planes flew with Seabee-type single vertical fin tail, and Bellanca-type tail with three vertical stabilizers. Aircraft is not yet certificated; two V-tails models have rolled out.

The Miami firm is the newest operation in the Aero-Industries complex, headed by Alexandre Berger and which includes Jacobs Aircraft & Engineering Co., engine manufacturers; Atlantic Aviation Corp., which makes aircraft and missile components at Boyertown, Pa.; Montgomery Enterprises, operator of the Pottstown, Pa., airport, and Penn Airways, a nonscheduled airline.

At Miami, Air Time Leasing now has two Aero Commanders, one Piper Apache and four Cessna 195s. In addition, it has six Aero Commander 500Bs and six Commander 560Fs on order.

Mrs. Lucia G. Steward, director of sales, said the company currently has signed five firms, including a contractor and the other a manufacturer. She said Air Time Leasing also intends to run a lease-back operation, in which it will purchase a company's air fleet and lease it back on a guaranteed time basis, furnishing the crew and services.

Eventually, Mrs. Steward believes, Air Time Leasing will be fairly active in the aircraft brokerage field through acquisition of business fleets and has hired a man to investigate this field.

Florida Concentration

The company, she said, plans to concentrate operations in the Florida area for the next five months or so, before expanding nationwide. There is considerable interest, Mrs. Steward added, in flights in the Caribbean area. One client, Blanchard Machinery, has signed up for Cessna 195 and Piper Apache service for trips primarily in the Florida area.

Air Time Leasing furnishes the plane, pilot, maintenance and insurance to the contracting firm, as will Private Air Travel, Inc. Both companies will supply dispatching services. Eventually, Mrs. Steward continued, Air Time Leasing will add helicopters and larger transports to its fleets. At the moment, the helicopter type decision has not been made, but Mrs. Steward envisions Douglas DC-3s and Lockheed Lodestars as the class of "larger transports."

As far as the nationwide operation goes, Mrs. Steward, who conceived the Air Time Leasing idea and sold it to Aero-Industries, a survey now is under way on potential bases. The company, which has had one public stock issue, is capitalized at "in excess of $1 million," according to Mrs. Steward.

Air Time Leasing is taking no charter business "at the moment," but is concentrating its sales efforts on contracts ranging from one to five years. Roughly,

an Aero Commander will cost about $117 per hour on a 200 hr. guaranteed time year's contract, she explained.

Mrs. Steward said Air Time Leasing will add another plane to its fleet for each 600 hr. of time sold to clients.

The company is quartered in offices leased from American Airmotive at Miami International Airport. General manager is L. Clark Beecher, and Charles J. Ross is director of operations. Company now is hiring additional flight and ground personnel.

Private Air Travel, Inc., is based at Port Erie Airport and is headed by Earl E. Kearns, who resigned as manager of General Electric's Transportation Division after 34 years of service in the field of subway and surface transport components.

Kearns has been negotiating with Beech, Cessna, Piper and Mooney aircraft companies on commitments for an initial Private Air Travel order that could run as high as 100 airplanes.

In effect, Private Air Travel is offering a complementary feederline type service connecting, as Kearns put it, "the many, unserved places with cities having scheduled airline service." He said that of about 3,200 public airports, only about 600 have scheduled service. The company has applied for an FAA permit to operate air taxi service.

No Stock

Organization of Private Air Travel, Inc., is the culmination of an idea that was about 12 years in gestation. Associated with Kearns are R. H. Palmer, vice president and national sales manager, and David Gifford, legal counsel. Company has no stock offering on the open market.

Private Air Travel currently is setting up its operations in the northeast section of the U. S., gathering letters of intent to use the service from various corporations. Kearns said the results so far, which include no money transactions, are "most encouraging."

The company will start service when contracts signed within a 100 mi. radius of a designated airport justify the basing of five airplanes there. Each airport will have its own dispatching service and Private Air Travel is hiring its own pilots, who must have ATR and instrument ratings.

In addition, Kearns said, Private Air Travel plans to buy some single engine planes (such as the Mooney and Bonanza) for the so-called "hobby pilot" who wants to contract for a fixed number of hours per year. Company planes also can be flown by duly qualified pilots on the contract basis, and left at destination, with Private Air Travel picking the plane up or rescheduling it from that airport.

Kearns cites these advantages to

Civilian Aircraft, Engines Shipments

May 1960

Item		May 1960	Cumulative totals Jan.-May 1960
Complete aircraft, total airframe weight	1,000 lb.	3,159.7	12,919.8
By weight of plane:			
Under 3,000 lb. airframe weight	do	797.0	4,038.7
3,000 lb. airframe weight and over	do	2,362.7	8,881.1
By number of places:			
1- and 2-place	do	744.5	3,746.6
3- and 5-place	do		
Over 5-place	do	2,415.2	9,173.2
By total rated horsepower, all engines:			
Under 100 hp	do	617.0	3,184.3
100-399 hp	do		
400 hp. and over	do	2,542.7	9,735.5
Aircraft engines:			
Reciprocating	Number	894	5,163
One turbine	do	(D)	(D)
Aircraft engines, total horsepower:			
Reciprocating	1,000 hp	188.3	1,114.8
Gas turbine	do	(D)	(D)
Complete aircraft	Number	802	4,039
By weight of plane:			
Under 3,000 lb. airframe weight	do	752	3,837
3,000 lb. airframe weight and over	do	50	202
By number of places:			
1- and 2-place	do	733	3,732
3- and 5-place	do		
Over 5-place	do	69	307
By total rated horsepower, all engines:			
Under 100 hp	do	657	3,401
100-399 hp	do		
400 hp. and over	do	145	638
Value of shipments of complete aircraft and parts, total	$1,000	145,929	610,166
Aircraft, total	do	135,461	561,984
Under 3,000 lb. airframe weight	do	14,196	70,786
3,000 lb. airframe weight and over	do	121,265	491,198
Aircraft parts	do	10,468	48,182
Value of shipments of aircraft engines and parts, total	do	14,454	76,953
Aircraft engines:			
Reciprocating	do	2,266	13,084
Gas turbine	do	(D)	(D)
Engine parts	do	12,188	63,869
Unfilled orders (planes 3,000 lb. airframe weight and over)	Number	550	

* Revised.

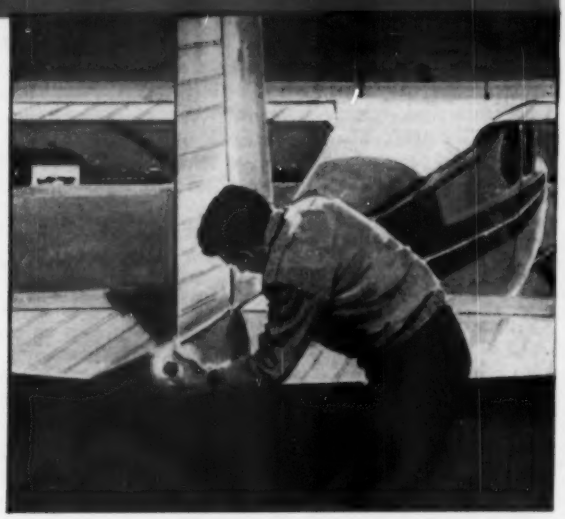
D—Withheld to avoid disclosing figures for individual companies.

Source: Bureau of the Census, Industry Division.

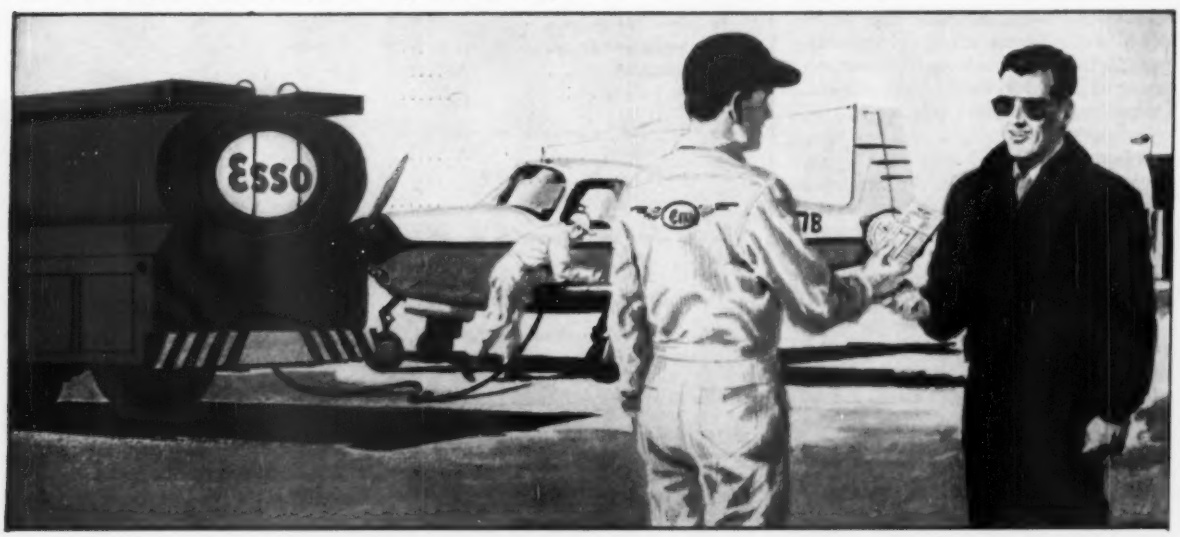
ESSO

WING TIPS

DON'T BE A CLOUD SKIPPER — Flying too close to Old Man Cumulus is inviting mid-air collision. If another plane breaks through the clouds, chances are its pilot won't see you in time. Bear in mind that the legal "thousand on top" leaves you very little leeway — particularly in jet territory.



TAKE 5 —Although checking lights before night flights is SOP, many pilots fail to take the 5 seconds necessary to check their tail light. Running into old friends is fine, but not while flying. So take 5 — and stay alive.



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potential time-lease contractors:

- **Nationwide airplane fleet** available on call.
- **Full coordination** by central dispatching service.
- **All planes in the fleet** available to all customers.
- **Major cost reductions** due to increased annual hours per plane; less layover time; reduction in deadheading; joint use by various companies to increase seat occupancy; standardization of equipment, and volume operations.

Kearns breaks down the yearly fixed cost of a privately owned plane this way: 2.5% interest, 6.5% depreciation, 2% insurance, 2% operations and dispatching, 1% hangar and 4.5%, pilot's salary, for a total of 18.5% of the cost of the airplane.

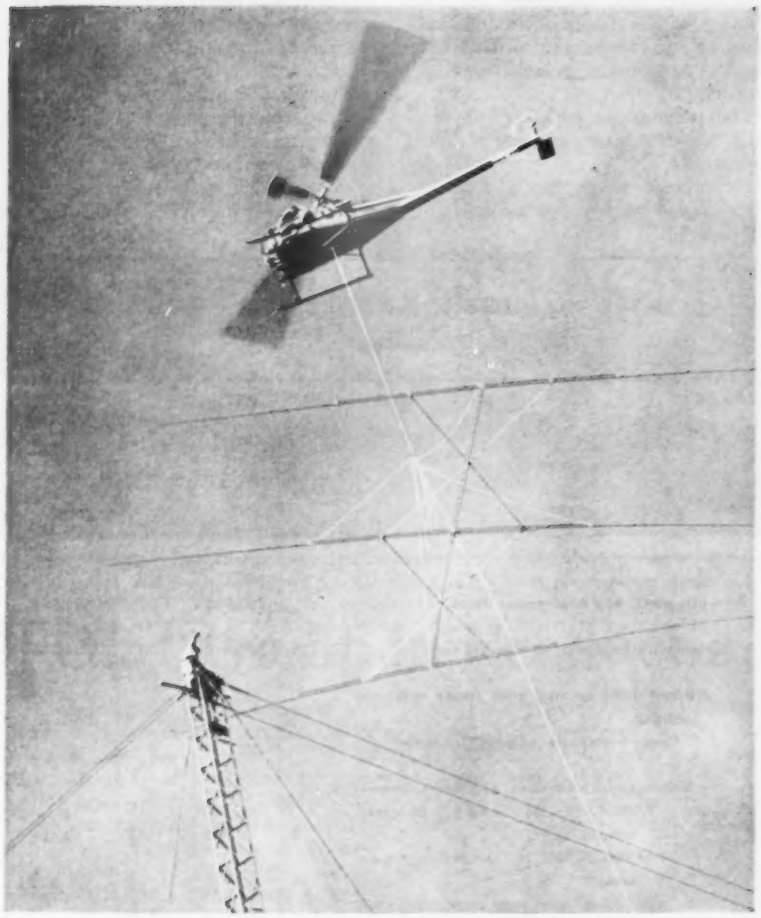
Time Charges

On the other hand, cost to the Private Air Travel contractor is 4.5% of the total cost of the plane, since the company pays all the above fixed charges. In general, Kearns said, a contractor would pay about $90 per hour for a Cessna 310, based on a 200 hr. yearly utilization deal.

A corporate contract works this way: the company signs up for a specific make and model of airplane, tailored to his needs, a number of annual flight hours, prepurchases a part of the final contract-year service, and makes monthly payments covering fixed charges and hourly usage.

Intriguing facet of this arrangement is the prepurchase payment, which Kearns refers to as a "modest deposit, less than the annual interest rate on cost of an airplane." This money comes to Private Air Travel as income, and will be used in financing of aircraft purchases, thus alleviating the need for the company to go outside for capital.

Kearns said the prepurchase agreement involves:



Hiller Unveils 12E Executive Version

Three-place Hiller 12E helicopter, flown by test pilot Bruce Jones, installs one of two antennas atop a 112-ft. tower at Stanford University's Radioscience Laboratory. Technician on tower clamped antennas into place after they were lowered by the 12E. Antenna will be used to receive signals bounced off the ionosphere from a station 5,000 mi. away. Below is the new Hiller E4 executive helicopter, a four-place version of the 12E, powered by a 305 hp. Lycoming engine. Stanley Hiller said first deliveries will be made this fall. Owners of 12Es can obtain a kit to modify the aircraft to executive configuration. E4 production price is $69,960.

• **Insurance that customers** are contracting with a financially-sound company, able to expand its airplane fleet as rapidly as customer commitments are received.

• **The prepurchase payment** is a contract "expense" item and not a capital investment.

• **Prepurchase money can be recovered** after a year on a pro rata basis, continued to pay monthly costs or, in the fifth year, applied to contract renewal, or refunded in cash, all at the customer's option.

Company contends that equity financing from the outside would require a substantial return on investment, with resultant continued stock or equity sales to expand the fleet. Kearns refers to the prepurchase agreement as "a modest amount of pump priming," in which the customer receives a major return of those funds through time and money savings, and convenient air travel service.

To stimulate national interest, Private Air Travel is offering dealers and distributors opportunities to expand their incomes beyond aircraft sales commissions alone. The program involves no distributor or dealer equity in the company, and no prime responsibility for operations.

Distributor Gains

They will gain, according to Kearns, these advantages:

• **Commissions on airplanes** purchased by Private Air Travel to fulfill contracts negotiated with customers in the dealer's territory.

• **Fees for aircraft servicing** and hangaring as arranged with Private Air Travel.

• **Three per cent** of the gross monthly revenue realized from Private Air Travel customers who have contracted for that dealer's or distributor's make of airplane in his territory. This should result, Kearns thinks, in an ideal selling arrangement of dealer-distributor and Private Air Travel teams, for mutual benefit.

• **Expansion of the dealer's** over-all business, including aircraft sales, leasing, charter, rental, service, storage and flight instruction, due to an expansion of flying by Private Air Travel's program.

Kearns emphasized that the Private Air Travel system is not competing with feeder airlines and, in fact, cannot, since the average passenger mile cost on a feederliner is about eight cents, against 12 cents for Private Air Travel planes.

Dispatching under the joint use plan, Kearns continued, further reduces costs since the load factor will remain high and trip costs thus shared.

At present, Private Air Travel employs about 30 persons who now are in the field calling on corporations to sell the plan and gain firm commitments. Eventually, Kearns said, Private Air Travel will hire up to 150 pilots

Aircraft, Parts Exports

April 1960

Item	April 1960		Cumulative totals January-April 1960	
	Number	Value ($1,000)	Number	Value ($1,000)
Aircraft, parts, and accessories, total	...	133,516	...	400,755
Commercial and civilian aircraft, total	238	54,812	712	136,746
Aircraft 3,000 lb. and over empty airframe weight:				
Cargo transports, commercial, new	...	...	...	...
Passenger transports, commercial, new:				
3,000-4,999 lb. empty airframe weight	8	712	19	2,124
15,000-29,000 lb. empty airframe weight	...	...	1	820
30,000 lb. and over empty airframe weight	9	45,613	26	116,547
Rotary wing aircraft, commercial, new	1	200	2	488
Commercial and civilian aircraft, used and rebuilt, including converted	15	4,981	46	7,983
Aircraft under 3,000 lb. empty airframe weight:				
Utility, commercial and civilian, new:				
3 places and under	32	243	117	919
4 places and over	110	1,754	349	5,735
Rotary wing, commercial, new	21	989	28	1,354
Commercial and civilian aircraft, used and rebuilt, including converted	42	320	124	776
Commercial and civilian aircraft, new, n.e.c. (all empty airframe weights)	...	...	...	...
Aircraft engines, reciprocating, new air-cooled under 400 hp[1]	162	402	468	1,106
Aircraft engines, reciprocating, used and rebuilt	143	1,022	465	3,058
Aircraft components, parts, and accessories, n.e.c.[2]	...	77,280	...	259,845

Source: Foreign Trade Division, Bureau of the Census.

[1] Air-cooled reciprocating engines, new, 400 hp. and over are included in "Aircraft components, parts, and accessories."

[2] Includes military aircraft.

Lightweight Spray System Developed for Bell 47Gs

Agricultural Aviation Engineering Co., Santa Clara, Calif., has developed a new lightweight spray system for Bell 47G-2 helicopters. System involves a spray boom installed aft and below the cabin; tanks contain a total of 120 gal. and are made of Fiberglas-reinforced epoxy resin. Boom incorporates a "Crop Line" spray control valve with a built-in aspirator system in its bypass port which creates an immediate negative press on shut-off, cutting the spray flow at the end of each swath run.

FIRST PROTOTYPE Utva 56, Yugoslavian multi-purpose airplane, lifts off the grass strip at Venice-St. Nicolo Airport to begin impressive demonstration. Plane showed remarkable maneuverability and controllability at low-speed end of its wide performance range.

Yugoslavian STOL Utva 56 in Production

By David A. Anderton

Venice—First Western appearance of the multi-purpose Yugoslavian Utva 56 at the Eighth International Aeronautical Display here heralded its entry as a competitor with U. S. and European airplanes in the STOL field.

Comparable in dimensions, layout and performance to such designs as the German Dornier Do. 27, Czech Brigadyr or U. S. Helio Courier, the Yugoslavian plane impressed technical observers with its outstanding flight performance and excellent workmanship.

The aircraft demonstrated at Venice's St. Nicolo Airport was flown by Peric Mjlcko and was the first prototype. Design of the Utva 56 was done by Branislav Nikolic and Dragoslav Petkovic, both engineers of the Fabrika Aviona Utva at Pancevo, Yugoslavia.

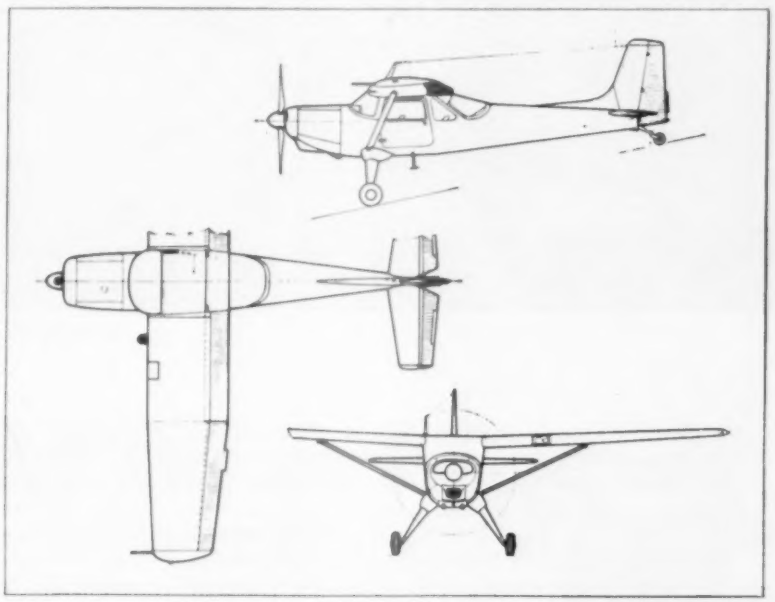
First production run of the Utva is now under way with an initial order for 10 airplanes. Export price and conditions are not yet available, said company representatives. Although the plane can be powered with a Czech-built Praga Doris B engine, probably chosen as a gesture toward the Russian-dominated Eastern bloc aircraft industry, the powerplant for the aircraft demonstrated here was a Lycoming GO-435-C2B2 engine driving a Hartzell constant-speed propeller.

Major aerodynamic feature is the use of drooped ailerons with deflected flaps to give a full-span flap effect on the wing. At maximum flap deflection of 38 deg., ailerons droop through 15

Utva 56 Specifications

Wingspan, ft.	37.4
Over-all length, ft.	27.2
Over-all height, ft.	8.5
Wing area, sq. ft.	192.8
Takeoff weight, lb.	2,860
Maximum speed, mph.	155
Stalling speed, mph.	49.7
Cruising speed, mph.	112-143
Rate of climb, fpm	1,140
Takeoff distance, ft.	915*
Landing distance, ft.	1,323*
Still-air range, mi.	372
Service ceiling, ft.	16,400

* Over 49-ft. (15 meters) obstacle



THREE-VIEW drawing of Utva 56 shows conventional layout and esthetically pleasing configuration. Observers at the display were impressed by the high quality of workmanship shown on this first prototype and the attention paid by its designers and constructors to details. Wingspan is 37.4 ft., over-all length is 27.2 ft. and over-all height 8.5 ft.

This is the only way to judge the true speed of business aircraft

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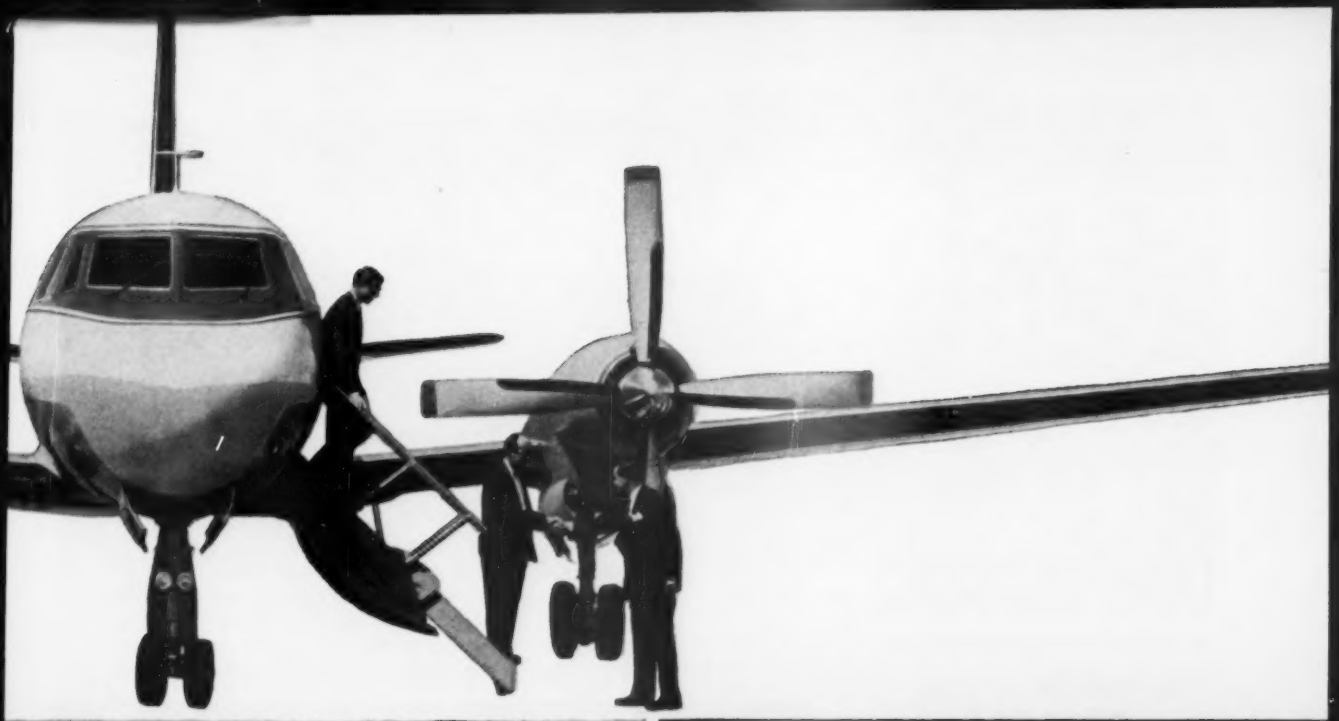
How does the Gulfstream performance compare to piston type aircraft and to pure jets? Our distributors will be happy to give you complete information and detailed specifications, and also arrange a practical demonstration of the aircraft.



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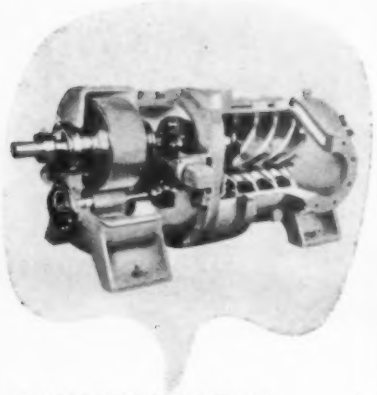

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Main Plant: Bay Shore, L. I., N. Y.
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CLEAN LINES of Utva 56 show to advantage in this high-speed run past observers at the Eighth International Aeronautical Display organized at Venice's St. Nicolo Airport.

REAR PORTION of upper fuselage canopy swings upward to give access to large cabin of Yugoslavian Utva 56. Multi-purpose plane can handle ambulance tasks by removing cabin seats as well as agricultural, sport or light transport work.

deg. and can still be operated differentially for lateral control.

Otherwise the airplane is a conventional all-metal layout, resembling its contemporaries in the STOL field. Although guaranteed performance figures given by the company would seem to rule out any claim for STOL performance—for example the landing distance over a 49-ft. (15 meter) obstacle is more than 1,300 ft.—in the hands of a pilot familiar with the airplane its take-off and landing performance put it squarely in that category.

Large cabin of the Utva 56 seats four persons, and can be converted to carry freight or stretcher cases by removing the seats. There are two passenger doors, one on each side of the cabin in the conventional location, and a third rear door, which is formed by the raised rear portion of the canopy aft of the wing spar. Optional installations include spray-dust equipment.

Standard instrumentation, including instrument flying and navigation aids, is fitted. The aircraft has a landing light and a second light for taxiing.

Designers say that any engine up to a maximum rating of 260 hp. can be installed. The Utva 56 also can be fitted with optional wheels, floats or ski landing gear.

Useful load is just over 1,000 lb. Fuel tanks hold 42 gal. and there is normal baggage allowance and space for 50 lb.

BELL HU-1A helicopters assigned to Army medical units operate on wet ground near a field hospital in Chile.

Bell Helicopters Aid Chileans in Disaster

Ability of Bell HU-1A Iroquois helicopter and its Lycoming T53 turbine powerplant to operate successfully under arduous weather and maintenance conditions was indicated during Operation Amigo, when the U.S. sent two Army ambulance medical detachments to earthquake-torn Chile to assist in disaster relief.

Accurate statistics reflecting the missions flown have only recently been available. The five HU-1As of the 56th Medical Detachment (Helicopter Ambulance) attached to the Army's 15th Field Hospital, Ft. Bragg, N. C., were heavily engaged in direct assistance; another HU-1A unit from the 57th Medical Detachment (Helicopter Ambulance), Ft. Meade, Md., was assigned emergency missions including supporting construction crews trying to strengthen a dam before it could break. This included flying drums of diesel fuel to supply bulldozers and other equipment.

Marginal Weather

The 56th's five Bells flew 169 missions in approximately two weeks for a total of 192.25 hr., carrying approximately 430 passengers and 77,320 lb. of cargo. The missions were accomplished during marginal weather approximately 90% of the time.

Illustrating flying conditions was one mission flown by Lt. Norman T. Elliott, assigned to airlift food, clothing and medicine to an isolated area, surrounded by mountains and located on a lake, from which no communication following the earthquake had been available.

In attempting to land, Lt. Elliott and his Chilean air force observer encountered strong gusty winds. After takeoff, wind conditions became severe; at one time the pilot looked at his airspeed indicator and saw it registering 100 kt. and upon checking the ground found that the aircraft was hovering without making any headway. Lt. Elliott reported that he held the controls still, with pitch down, until the winds picked him up and pushed him over the rim of a mountain. After passing the rim he pulled pitch and started climbing to 10,500 ft., then made a long dive toward his home base.

Three helicopters assigned to the

U. S. Business & Utility Aircraft Shipments

May 1960

Manufacturer and Model	No. of Units	Net Billings
Aero Design 500	3	$507,000
560E	1	
680E	3	
Beech 185	6	$4,222,000
65 Queen Air	6	
33 Debonair	34	
35 Bonanza	20	
95 Travel Air	15	
50 Twin-Bonanza	12	
Callair A-5	1	$6,000
Cessna 150	40	$5,719,000
172	84	
175, Skylark	34	
180	26	
182, Skylane	61	
210	86	
310	30	
Champion 7EC Traveler	1	$153,000
7FC Tri-Traveler	3	
7GC Sky-Trac	15	
7JC Tri-Con	3	
7HC DX'er	2	
Mooney Mk. 20	14	$263,000
Piper PA-18	23	$3,842,000
PA-18-A Super Cub	1	
PA-22 Tri-Pacer, Caribbean	31	
PA-23 Apache 160	2	
PA-23 Aztec 250	46	
PA-24 Comanche 180	22	
PA-24 Comanche 250	56	
PA-25 Pawnee	50	
Totals	731	$14,712,000

In the five-month period January-May this year, 3,775 business and utility aircraft have been shipped by the above builders, having a total factory billing value of some $73,799,000. This is an increase of 432 aircraft and $17,838,000 over the same period last year.

island of Chiloc operated there for nine days without maintenance being required, amid low clouds, rain, fog and poor visibility. Most of the terrain was such that a safe autorotation was not possible and approximately 40% of the flying was over the ocean. These HU-1As flew a total of 79:45 hr., carrying out 81 missions and airlifting a total of 51,200 lb. of material, including building materials, such as corrugated metal sheeting, which was often piled completely to the cabin roofs. Distance traveled by this detachment is estimated at 17,000 mi.

Observers on the scene noted that the HU-1As used fuel, supplied in 55-gal. drums, that was supposed to be JP-4, but from the post flight color and appearance of the hot end of the T53s, the fuel is suspected to have been JP-1. Fuel was hand pumped, and no strainers or water separators were available. Yet there were no incidents or accidents reported during the entire operation.

Aircraft were flown to Chile disassembled in Douglas C-124 Globemasters and assembled on the edge of the airstrip immediately after unloading on rocky and extremely wet ground.

Lualdi Demonstrates L.59 Helicopter

Lualdi L.59 four-place helicopter, built around the Hiller rotor system, was demonstrated at Eighth International Aeronautical Display at Venice-St. Nicolo Airport early in July. Helicopter, a development of the earlier L.55 (AW June 23, 1958, p. 57), is powered by a single 260-hp. Continental IO-470-D engine. L.59 has 360-deg. visibility from cockpit, giving the pilot an unexcelled view of the terrain during low-level operations. Exhaust ejector system (under belly) adds some thrust-horsepower to the engine installation. Streamlined objects on fuselage top are fuel tanks. Paired wheels on tail boom are attached to retractable strut to ease ground handling of the helicopter, which normally uses skid gear. Rotor diameter of the L.59 is 34.8 ft., gross weight is 2,557 lb. Maximum speed is approximately 160 mph. Two-bladed rotor is all-metal, made by Parsons in U. S.

Morane-Saulnier Gets 200 Rallye Orders

Paris—Morane Saulnier, reports it has orders for close to 200 MS-880 sport airplanes.

The private French aircraft firm reports orders for the three-place, all-metal Rallye (AW June 20, p. 272) have reached this level since the aircraft was first demonstrated to customers in May. Morane Saulnier is currently showing its single prototype throughout western Europe.

Morane-Saulnier officials say that 97% of potential customers want the aircraft in tricycle gear configuration, and 60% are requesting the Continental 145 hp. O-300 engine.

Rallye is offered in 90 hp., 100 hp. and 145 hp. versions. Price ranges from $5,000 for the 90 hp. version to $6,900 for the 145 hp. model.

The 145 hp. version, called the Super-Rallye, can be operated at a cost of 1.62 cents per seat-kilometer. This figure includes amortization and is based on 300 flight hours annually. Cruising speed is 110 kt. with the 145 hp. engine.

PRIVATE LINES

First Bell 47J-2 Ranger helicopter for Alaska was delivered to Anchorage Helicopter Service, Inc., for commercial charter work. Aircraft was ferried from the factory in Hurst, Tex., covering the more than 3,000 mi. in 46.3 flight hours, four days elapsed time. Flying at an average speed of 90 mph., the 47J-2 Ranger averaged 16.5 gal. of fuel per hour.

Howard Aero 500 executive transport will undergo vibration testing of wings and tail to meet Federal Aviation Agency certification requirements, using equipment and technicians supplied by Chance Vought Aircraft's Aeronautics Division under subcontract. Work is first subcontracting handled by the company at locations outside its Dallas plant.

British Accident Investigation Report:

Pilots Misread Altimeters in BOAC Crash

(Following is a report to Minister of Aviation Duncan Sandys from P. G. Tweedie, chief inspector of accidents, into circumstances involving the crash of a Bristol Britannia 312 turboprop transport, owned by British Overseas Airways Corp., on a test flight near Sopley Park, Christchurch, Dec. 24, 1958. Killed were Capt J. E. Jackson, the pilot; Engineer Officer C. D. Woodhouse, and seven BOAC employes; the first officer and two engineers were injured.)

Notification was by telephone from Southern Air Traffic Control Center at 1245 hr.[1] on Dec. 24, 1958. The scene of the accident was visited the same day.

The aircraft was making a test flight in connection with the renewal of its Certificate of Airworthiness. It took off from London Airport at 1010 hr. and during the ensuing climbs it reached an altitude of about 18,000 ft. The captain carried out further tests and at 1153 hr. he requested permission to descend from 12,000 to 3,000 ft. About three minutes after the commencement of the descent the aircraft struck ground, which was obscured by fog.

The aircraft was constructed by Bristol Aircraft, Ltd., in 1957 and first received a Certificate of Airworthiness on Dec. 3, 1957. It was delivered to BOAC on Dec. 6, 1957, and thereafter was maintained by the corporation to approved maintenance schedules. On Dec. 3, 1958, the Certificate of Airworthiness was renewed for a further year. Prior to the last flight the aircraft had flown a total of 1,512 hr.

A Check 4 inspection in conjunction with Group D of the progressive overhaul program was carried out on the aircraft between Dec. 14 and Dec. 23, 1958. Part of this work involved the calibration of the pilots' altimeters, airspeed indicators and rate of climb indicators. The aircraft was certified as serviceable for the test flight. The weight and load distribution were within the prescribed limits.

The Crew

Capt. J. E. Jackson, aged 46 years, was a senior captain-first class and the officer-in-charge of training for Britannia 312 aircraft in BOAC. He held a valid airline transport pilot's license endorsed in group I for Britannia 100 and 300 aircraft. The license included current instrument and inspector's ratings. He also held a general flight radio-telephony operator's license. He had held a flight navigator's license but had not renewed it after Dec. 24, 1954. Capt. Jackson's total flying experience amounted to about 9,000 hr., of which 909 hr. were in Britannia aircraft. He was considered by BOAC to be a reliable competent captain with exceptional ability and had received accelerated promotion to senior captain-first class in September, 1956.

First Officer K. Myers, aged 27, holds a valid airline transport pilot's license endorsed in Group I for Britannia 100 and 300 aircraft and a current instrument rating. He also holds a valid flight navigator's license and a general flight radio-telephony operator's license. Mr. Myers' total flying experience amounts to 4,127 hr. of which 550 hr. have been obtained in Britannia 312 aircraft in the capacity of first officer. He was considered by BOAC to be "above average" as a first officer.

Engineer Officer C. D. Woodhouse, aged 34 years, was acting as flight engineer on the subject flight. He held a valid flight engineer's license endorsed for Britannia 100 and 300 aircraft and a valid aircraft maintenance engineer's license. His total flying experience amounted to over 5,000 hr. of which 516 hr. were in Britannia 312 aircraft. Mr. Woodhouse was assessed "above average" as a flight engineer and he held the appointment of chief engineer officer instructor in the Britannia 312 fleet.

Engineer Officers J. Buckley and E. M. O'Keeffe, who were concerned with recording details of the flight, were qualified flight engineers, properly licensed and experienced in Britannia 312 aircraft.

The Weather

The weather forecast for the area of the flight for the period 0800 hr. to 1800 hr. drew attention to extensive areas of fog especially in the west and north; 6/8 to 8/8 stratocumulus clouds were forecast for the east of the area and spreading very slowly west. The height of the base of the cloud was estimated to be 1,500 ft. to 2,500 ft. with tops at 3,000 ft. Variable amounts of altocumulus and cumulus were forecast for heights of less than 10,000 ft.

An appreciation by the Meteorological Office of the weather conditions in the area London-Bristol-Hurn between 1000 and 1200 hr. is as follows:

General: Almost the whole of England was in a col area and the resulting pressure gradient was almost neglible.

Wind on the surface was light and variable; 2,000 ft., light, mainly northeasterly; 5,000 ft., 040 deg. T., 10 kt.; 10,000 ft., 030 deg. T., 10/15 kt.; 18,000 ft., 0.30 deg. T., 15/20 kt.; 25,000 ft., 350 deg. T., 25/30 kt.

There was extensive fog or mist and extensive areas of low stratus base clouds, surface-400 ft. tops about 1,500 ft. above mean sea level. Some clear areas were in the east at first. Patches of stratocumulus base were at 2,000-3,000 ft., tops about 4,000 ft. in the east of the area.

There may have been some well-broken altocumulus between about 10,000 and 12,000 ft. mainly in the west. No aircraft reports are available and observation of any such clouds from the ground was prevented by the fog and low stratus. However any such cloud would have been small in amount.

Visibility was generally 100-300 yards but 500-1,500 yards inland in the east at first and 1-3 naut. mi. in coastal areas east of the Isle of Wight. Freezing level was 4,000-4,500 ft. Airframe icing and turbulence was nil.

Note: In the vicinity of Hurn there would be complete coverage of fog and low stratus with tops about 1,500 ft. Above this there is likely to have been nil to small amounts of altocumulus type cloud about 10,000 to 12,000 ft.

The Flight

The aircraft took off from London Airport into a cloudless sky at 1010 hr. on Dec. 24 for a test flight in connection with the renewal of its Certificate of Airworthiness. The captain was at the controls in the left-hand seat and the first officer in the right-hand seat where he operated the R/T and was also responsible for the navigation.

Engineer Officer Woodhouse occupied the jump seat, between and slightly to the rear of the pilots; Engineer Officer Buckley was at the radio officer's station and Engineer Officer O'Keeffe at the navigator's position. The three engineers worked as a team but Engineer Officer O'Keeffe was primarily responsible for the recording of altitude, speed and temperature indicated by the navigator's instruments during the climbs. There were seven BOAC personnel in the passenger compartment.

During the takeoff the crew checked that both pilots' airspeed indicators read 119 kt. at the same instant. The aircraft climbed towards Woodley and on leveling out at 3,000 ft. the first officer cross-checked the captain's altimeter with his own. After passing Woodley at 1015 hr. the aircraft left airways and climbed southwesterly. At 5,000 ft. the first officer again cross-checked the pilots' altimeters. The propeller of No. 4 engine was feathered for test purposes and a 3-engined climb at takeoff was made to just over 9,000 ft. About six minutes later the climb was continued to 18,000 ft. with the three engines running at maximum continuous power. Records of altitude (indicated by the navigator's altimeter which was set at standard pressure), speed and temperature were recorded every 30 sec.

The first officer has stated that he considered it superfluous to carry out the prescribed spoken cross-check of pilots' altimeters during the climb as so many readings were being taken. While the aircraft was climbing through 10,000 ft. the pressurization system was set in operation. During the later stages of the climb, it was noticed that when the first officer's airspeed indicator read 130 kt. the captain's read 140 and the navigator's 135. At a speed

[1] All times in this report are Greenwich Mean Time.

of 180 kt. the discrepancies were less. After the completion of the climb, when all four engines were running normally, a series of handling tests were commenced. These included a high-speed dive lasting for about a minute, followed by several stalls carried out in various configurations. During the stall tests it was noticed that the first officer's airspeed indicator read 80 kt. when the captain's read 100.

Roll Checks

Rate of roll checks which followed were conducted during a 500 fpm. descent and were somewhat protracted because the required rate of roll could not be achieved. When these checks had been finished, the captain asked Engineer Officer Buckley if there were any further tests which could be done before descending to make baulked landing checks. The engineer officer suggested that the flap and undercarriage functioning tests could be made and at this stage he noticed the first officer's altimeter reading what he believed to be 13,000 ft. When the functioning tests were completed, the captain asked the first officer to get clearance to descend from 13,000 ft. to 3,000 ft. and said he also wished to know the heights of the tops of the lowest cloud layer at Hurn.

The first officer called Hurn Approach at 1134 hr. and requested information as to the height of the top of the cloud base. Hurn Approach replied "I haven't got an estimate here but we understand in the Southampton area they are VMC at 2,000 ft." At 1135 hr. the first officer replied "We'd like permission to descend to 3,000 ft. We're VMC on top at 13,000 ft. just above a cloud layer, we will come over the top of Hurn and have clearance from there if you please." A course was steered toward Hurn for about 18 min. and during this flight the first officer believed they were about 3,000 ft. above a cloud layer.

The southwest leg of the Hurn Radio Range was intercepted and followed to the range station and at 1153 hr. the first officer reported that they were overhead Hurn at 12,000 ft. VMC on top and requested descent clearance to 3,000 ft. Hurn Approach asked whether the descent could be made VMC, to which the first officer replied "Negative, there's a cloud layer at about 10,000." Hurn replied that if the aircraft was overhead it should contact London Airways and if it was to the west it should contact the Flight Information Region.

The aircraft established contact with the Flight Iinformation Region and said "We are overhead Hurn 12,000 ft. on top requesting IMC descent to 3,000 ft." The aircraft was advised that the Flight Information Region had no reported IMC traffic in the area west of Hurn and the aircraft was requested to advise when they had descended to 3,000 ft. in that area. This message terminated at 1155 hr. During the descent made at an airspeed of about 180 kt .the aircraft entered haze and the first officer expected, on passing through it, to see a second layer below, but to his surprise the ground suddenly appeared. An attempt to check the aircraft's descent was too late to prevent it striking the ground.

The aircraft broke up progressively and isolated fires broke out. Nine of the occupants were killed. The time of impact was about 1158 hr. and the position of the crash was within the area of controlled airspace near Hurn.

The three-pointer altimeter was a logical development of the two-pointer to meet the requirements of flight at higher altitudes. Spasmodically, during the years following the end of the war, research in the field of altitude presentation was carried out both in the United Kingdom and abroad.

In 1952, as a result of Comet I experience of operating over a wide range of altitudes, BOAC introduced a modified type of altimeter with which all its Britannia aircraft were equipped at the time of the subject accident. This altimeter had a 10,000 ft. pointer which extended to the outside scale and could not become totally obscured by the other pointers. However, as a result of an incident involving the misreading of an altimeter during flight, an order was issued by BOAC Flight Operations Department on May 22, 1958, the relevant part of which reads:

> Climbing and Descending: During climbs and descents the captain and the copilot are to cross-check their altimeters at 20,000 ft. and 10,000 ft. This is to avoid the possibility of misreading the altimeters by 10,000 ft., e.g. reading 5,000 ft. when the aircraft is, in fact, at 15,000 ft. or vice versa.

In 1958 there occurred an accident resulting from the misreading of an altimeter which, so far as is known, was the first accident of this type. As a result the Ministry, in collaboration with the Air Registration Board, took action to ascertain the practicability of:

(a) Modifying the three-pointer altimeter so as to eliminate as far as possible the chance of a 10,000 ft. reading error and

(b) Developing an instrument more suited to current operational needs.

On Feb. 16, 1959, following an assessment of the various possible modifications, the Air Registration Board issued a notice that Britannia, Comet and Viscount aircraft must be equipped with approved altimeters having a presentation where probability of a 10,000 ft. reading error is removed.

CAI Circular

On Feb. 25, 1959, the following Civil Aviation Information Circular was issued:

Flight Safety Warning

Reading the 3-Pointer Sensitive Altimeter

1. It is known that, with the existing presentation of 3-pointer sensitive altimeters, errors in readings of 10,000 ft. have been made in high-flying aircraft.

2. Errors in altimeter reading are most likely to be made when routine scanning of the instrument panel has been interrupted sufficiently for the sequence of the flight to be temporarily lost. Should this interruption occur during climb or descent, the height when monitoring of the instruments is resumed, may be very different from that anticipated. In these circumstances the customary rapid scan of the instruments with the object of detecting a pointer out of its usual or expected position can be dangerous.

3. Pilots of aircraft which operate in the range of altitudes where reference to the 10,000 ft. pointer on the instrument is necessary are reminded of the need for care in reading this type of altimeter, particularly:

(1) Prior to starting any stage of descent.

(2) At times when monitoring of the flight instruments has been, or is being, interrupted.

On Feb. 26, 1959, the United Kingdom Altimeter Committee was set up to investigate, inter alia, the design of altimeter faces and mechanisms.

After knocking down poles carrying low-tension and telegraph cables, the aircraft struck the ground with its starboard wing while flying approximately longitudinally level. It then broke up progressively as it traversed over level ground for a distance of some 600 yards. Several isolated fires broke out.

Wreckage Inspection

An inspection of the wreckage established that the flaps and undercarriage were retracted and that the fuel dump chutes were in the extended position. The engines were running under power at the time of impact. A number of flight test report forms, completed during the subject flight, were recovered from the wreckage and they provided details of temperature and altitude logged during the aircraft's climb. Subsequent examination of the wreckage failed to reveal any precrash defect in the airframe or engines.

The pitot and static pressure pipelines of the pilots' instrument panels were severed during the crash. Pressure tests carried out in situ of the lines which remained attached to each panel revealed a leakage in the static line of the captain's panel. Following the removal of the panel it was established that this was due to crash damage sustained by the rate of climb indicator.

Subsequent examination and tests of the first officer's instrument panel revealed a slight leak from the connecting union of the rate of climb indicator. The union was slightly loose and not wire locked. During the tests it was demonstrated that physical pressure on the panel could effectively seal the leak and it is possible, therefore, that the leakage was not detected during the preflight functional and pressure checks due to the rigidity of the pipeline system.

In this connection, the technical records relating to the inspection checks show that the instrument was removed for calibration and was then refitted. It has not been possible to determine the precise sequence of events which led to the absence of the wire-locking of the union.

A detailed examination and test of flying instruments carried out at the manufacturers' showed that the captain's altimeter functioned normally within its specified accuracy tolerance. The airspeed indicator had a consistent error of —6 kt. throughout its range but this was due to impact damage. The altimeter and airspeed indicator of the first officer were damaged by impact and no positive assessment of their pre-accident condition could be made. The navigator's altimeter also was damaged by impact but the airspeed indicator functioned normally within the specification tolerances.

The rate of climb indicators of both pilots suffered damage during the crash.

There are two separate systems to provide air at atmospheric pressure to a number of instruments including the airspeed indicators and altimeters. The first officers' and the navigator's instruments are supplied from a common source and are unconnected with that which provides pressure to the captain's instruments.

The discrepancies between the airspeed indications of the captain's and first officer's instruments which were noted during the flight are consistent with a pressure leak of the type subsequently found in the static system of the first officer's instruments. Such a pressure leak would, however, have no effect on the captain's altimeter. Calculations indicate that the effect on the first officer's altimeter would be small: perhaps something in the order of 300 ft. too low at 20,000 ft. and decreasing with descent.

They also show that if an altimeter indication of 10,000 ft. too high did result from a defective static pressure system when flying at an altitude of 3,000 ft. then an associated airspeed indicator would register a speed of 465 kt. when flying at 200 kt. "EAS."

Observations

Comparison of the outside air temperatures logged during the climb with the upper air temperatures provided by the Meteorological Office confirms that an altitude of approximately 18,000 ft. was attained.

At 1135 hr. the first officer reported to Air Traffic Control that the height of the aircraft was 13,000 ft. and at 1153 hr. 12,000 ft., i.e. a descent of 1,000 ft. in 18 min.

Between these times, according to the first officer, the aircraft flew toward Hurn approximately 3,000 ft. above a cloud layer. From a consideration of the meteorological conditions, however, it would seem that the only cloud layer which existed in the vicinity of Hurn was on or near the surface.

The final descent was commenced some time after 1115 hr. with the inboard engines at "flight idle" power and at an airspeed of about 180 kt. The dump chutes were in the extended position. Under these conditions the associated rate of descent would be about 750 fpm. It has been established that the aircraft struck the ground at approximately 1158 hr. It would seem therefore that at 1153 hr. the aircraft was at approximately 2,000 ft. and not 12,000 ft. as reported and that consequently some 10,000 ft. was lost prior to 1135 hr. without either pilot appreciating it. It might be of some significance in this respect that when the climb to 18,000 ft. was concluded the subsequent air tests were not of a kind which required the crew to focus attention on the altimeters.

Conclusions

1. The documentation of the aircraft was in order.
2. The crew was properly licensed.
3. The captain's altimeter functioned normally throughout the flight.
4. The first officer's altimeter may have been subject to some inaccuracy but such inaccuracy had no bearing on the cause of the accident.
5. The captain misread or failed to read the indicated altitude of the aircraft during the concluding stage of the flight.
6. The first officer misread his altimeter by approximately 10,000 ft. too high when reporting the aircraft's altitude to Air Traffic Control at 1135 and 1153 hr.

Opinion

The accident was the result of the aircraft being flown into ground obscured by fog. This was caused by a failure on the part of both the captain and the first officer to establish the altitude of the aircraft before and during the final descent. The responsibility for the accident must rest with the captain.

The height presentation afforded by the type of three-pointer altimeter fitted to the subject aircraft was such that a higher degree of attention was required to interpret it accurately than is desirable in so vital an instrument. This, when taken in conjunction with the nature of the flight on which the aircraft was engaged, was a contributory factor.

Compliance With Regulations

In conducting this investigation the provisions of Regulation 7(5) of the Civil Aviation (Investigation of Accidents) Regulations, 1951—Statutory Instrument 1951/1653—have been complied with, the following action having been taken:

The manner and extent of compliance in respect of the late Capt. J. E. Jackson:

On Sept. 21, 1959, a letter was sent to the Midland Bank, Executor and Trustee Co. Ltd., at Bournemouth as legal personal representatives of the late Capt. J. E. Jackson giving notice that some degree of responsibility for the accident might be attributed to Capt. Jackson. The letter offered the bank an opportunity of exercising its rights under Regulation 7(5) and informed it of the facilities that would be available for that purpose. As a result a meeting took place on Oct. 14, 1959, between the bank, its counsel and instructing solicitor and representatives of the Accidents Investigation Branch and the Treasury Solicitor's Department. Following the meeting representations were submitted to the Chief Inspector of Accidents on Nov. 6, 1959, and Jan. 11, 1960.

The manner and extent of compliance in respect of First Officer K. Myers:

On Sept. 21, 1959, a letter was sent to Mr. Myers giving notice that some degree of responsibility for the accident might be attributed to him. The letter offered Mr. Myers an opportunity of exercising his rights under Regulation 7(5) and informed him of the facilities that would be available to him for that purpose. On Nov. 25, 1959, a representation from Mr. Myers was sent to the Chief Inspector of Accidents together with an indication that a meeting to elaborate on the representation would be appreciated. As a result a meeting took place on Dec. 22, 1959, between Mr. Myers, two members of the Executive Council of the British Air Line Pilots Assn., acting as his advisers, and representatives of the Accidents Investigation Branch and the Treasury Solicitor's Department. At this meeting Mr. Myers and those accompanying him expanded their representation and there was a long discussion on the various points raised.

Careful consideration has been given to the representations made on behalf of the late Capt. J. E. Jackson and by Mr. K. Myers and as a result the Chief Inspector has added paragraph 6.2 to the opinion . . . The height presentation afforded by the type of three-pointer altimeter. . . . "see above."

P. G. TWEEDIE,
Chief Inspector of Accidents

Sud Aviation Frelon Completes Company Tests

Sud Aviation's triple-turbine Frelon helicopter has completed major portion of company tests and is being turned over to the French government for further testing (AW July 13, 1959, p. 30). Frelon registered maximum speed of 131 kt., cruised at 124 kt. and flew at altitudes up to 13,123 ft. Civil version can haul 28 passengers.

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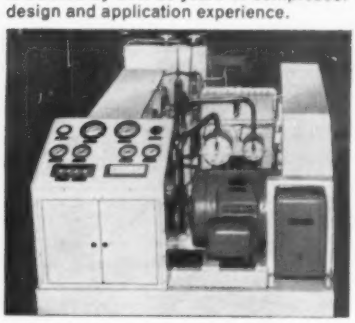

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WHO'S WHERE

(*Continued from page 23*)

Changes

James V. Bitner, Jr., assistant general manager, Instrument Division of Lear, Inc., Grand Rapids, Mich.

Charles S. Wagner, assistant general manager, Lockheed's Georgia Division, Marietta, Ga.

Donald K. Adams, director of liaison engineering, TransDigital Systems Division, Cook Electric Co., Franklin Park, Ill. Also: **Col. E. T. Bullock** (USA, ret.), director of planning.

Hunter C. Harris, technical manager, Systems Engineering and Management Operation of Sylvania Electronic Systems, Needham, Mass., a division of Sylvania Electric Products, Inc.

Dr. Frank Genevese, Dr. Vincent J. Berinati, and **Dr. John M. Walker** have joined the staff of Westinghouse Electric Corp.'s Military Advanced Systems Planning Group (WASP), Washington, D. C.

Ed Woodhams, laboratory director of National Astro Laboratories, Inc., Pasadena, Calif.

Glenn A. Murray, manager of the newly formed Cryogenic Products Department, Linde Co., Division of Union Carbide Corp., New York, N. Y. Other appointments: **P. P. Huffard, Jr.**, sales manager; **R. L. Thompson**, manager of engineering and development; **E. L. McCandless**, associate technical director.

Robert P. Norton, department manager of base activation Arma Division, American Bosch Arma Corp., Garden City, N. Y., and **William E. King**, department manager of field service.

William F. Romig, special assistant to the vice president for government-industry relations of Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y.

W. E. Giberson, chief of the newly organized Guidance and Control Division, California Institute of Technology's Jet Propulsion Laboratory, Pasadena, Calif.

Myron A. Tracy, manager of military relations, Washington, D. C., for The Garrett Corp.

Francis C. Morris, customer relations director, Components Division, Plasmadyne Corp., Santa Ana, Calif., a subsidiary of Giannini Scientific Corp., and **James J. Gray**, sales manager.

Dr. A. Victor Stern, manager of the newly established systems laboratory, Hughes Aircraft Co.'s Ground Systems Group, Fullerton, Calif.

A. M. (Tex) Johnston, assistant program manager for design and test—Dyna-Soar manned space glider, Boeing Airplane Co., Seattle, Wash.

David F. Shaw, general manager, General Electric Co.'s Aircraft Nuclear Propulsion Department, Flight Propulsion Division, Cincinnati, Ohio.

D. F. Folz, director of Lockheed Aircraft Corp.'s diversification task force, Burbank, Calif.

Dr. James W. Moyer, research director of the Sperry Rand Research Center to be built in Sudbury, Mass.

Col. W. W. Bailey (USAF, ret.), assistant general manager, Communications & Weapons Systems Division of Philco Corp.'s Government & Industrial Group, Philadelphia, Pa. Also: **George Masurat**, manager of manufacturing.

Dr. Arthur Mager, associate director, Aerothermodynamics Department, National Engineering Science Co., Pasadena, Calif.

Cessna Dealer Expands on West Coast

Skyways, Inc., a new Cessna dealership under Airflite, Inc., West Coast distributors for Cessna, will occupy this $700,000 business and private plane facility scheduled for completion in mid-October at Van Nuys, Calif. Construction includes 20,000 sq. ft. of hangar area, 18,000 sq. ft. of office space, 23,000 sq. ft. of storage area and 14 acres of paved ramp. Included will be a 100-seat conference room fully equipped with projectors and visual display aids for use by corporation aircraft executives desiring to hold meetings at the airport en route during sales tours. Office building's first floor will have a 4,000 sq. ft. showroom capable of handling five planes up to 310 size. Newly organized Skyways, Inc., is headed by Finley C. Brinley, real estate broker and formerly in the auto and grocery business.

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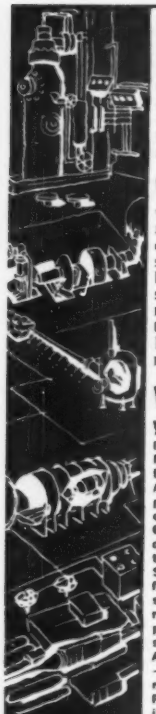

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LETTERS

Top Notch Reporting

I wish to take the time from a busy day to point out that David A. Anderton's pictures from Royal Flush Five (AW June 6, pp. 78-79) are an example of top notch reporting.

AVIATION WEEK normally arrives on Monday of each week, except that here in Europe it is four weeks old and arrives with Flight and the Aeroplane which are only two days old. Therefore, those articles in which the editors have gone to great effort to present an original approach really stand out.

I was not associated in any way with the operation described in this article, but it is refreshing to have some news of articles in operational service mixed with the latest plans for 1970 launchings.

B. G. DUDLEY
Captain, USAF
1616th SUPPRON
APO 10, N. Y.

(AVIATION WEEK's air international edition, $25 per year, is air-freighted to Europe and reaches subscribers one day after it reaches U. S. subscribers. Capt. Dudley apparently gets a sea mail edition available at $20 a year.—Ed.)

Pointed Comment

Your editorial in AVIATION WEEK of May 16 seemed to me excellent, and much more to the point than most of the comment at the time.

I'm trying to write an article on the general topic of war and foreign relations and I'd like to quote a paragraph with your approval.

ROBERT BERKOWITZ
Mathematics Department
Baird-Atomic, Inc.
Cambridge, Mass.

Military Pilot

After reading Lt. McDaniel's letter (AW July 4, p. 102) expressing his disgust and unhappiness with his assignment with the Strategic Air Command and, indirectly, the Air Force, I was tempted to write him directly and give him my personal views on the matter.

However, after reading Lt. Boehler's letter (AW July 18, p. 154), I find that this is not necessary. I can only say to Lt. Boehler—BRAVO!

Before being too harsh on Lt. McDaniel, I believe that one should know all the facts. I wonder if his superiors—and they include his Aircraft Commander, his Operations Officer, and his Squadron Commander—ever attempted to explain to this officer exactly where he fitted in the organization? I do not believe that Lt. McDaniel is alone in his feelings and I see that Lt. Boehler agrees.

During my recent seven-plus years in SAC, I found that this is a common ailment among the new and junior officers. Once they have been oriented to the mission of the unit, and of SAC, most of them do a superior job even as a "checklist reader."

If Lt. McDaniel has received this counseling from his superiors and still retains this self-pity, then indeed SAC and the Air Force would be better off without his services. I would like to hear his views after a year or so of being "ensnared in the jaws of industry." Advancements come after demonstrated performance and experience and this is equally applicable to industry or the Air Force. The mission of SAC is so important that no one can be bought at "face value," rather, he must prove his ability to contribute whether it be as a co-pilot, engineering officer or a crew chief on the line. I can personally assure him that if he does demonstrate a capability to do the job, regardless of the job, he will find that advancements will be forthcoming.

Today's Air Force needs officers and airmen who realize their duty is to the mission. I think that Lt. Boehler's statement that "you are an officer first, a pilot second" is most apropos to not only Lt. McDaniel but all of us.

WILLIAM K. CALLAM
Lt. Colonel, USAF
Directorate of Operational Requirements
Headquarters, USAF

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

BOAC Comet Service

It is not often that we find an error of fact in AVIATION WEEK, but there is one on p. 43 of your June 27 issue.

In the box headed "Atlantic Jet Timetable" you state "Only Pan American, Qantas and TWA had jet services the previous year [1959]." BOAC certainly was not flying 707s across the Atlantic, but their Comets had been operating on the route since October, 1958.

I think this is an error of omission rather than commission, particularly as you do admit BOAC's Comet service in the last paragraph, but I can't let this pass in view of the possible implication that the Avon is not a jet engine.

A. I. FENWICK
Public Relations Manager
Aero Engine Division
Rolls-Royce, Ltd.
Derby, England

Editorial Viewpoint

Congratulations on your July 4 editorial consisting of selections from Dr. Killian's commencement address at MIT. His breadth of vision and balanced viewpoint give form to the tangled issues of our role on the international scene.

Dr. Killian's remarks were certainly more helpful to me than Robert Hotz's weekly plea for more government money for the aircraft industry. Mr. Hotz affects an air of broad patriotic interest like Dr. Killian's, but the monotony of Mr. Hotz's conclusions quickly show that his interest rarely goes beyond the industry for which he speaks.

As a leading spokesman for a giant industry, Mr. Hotz owes us a broader view.

The following quotes from recent editorials illustrate the point:

Apr. 11—"The problem now is to stick to the objectives detailed in the NASA program and to push their achievement with the full budgeting and technical support they require."

May 9—"There is little doubt but that this budget ceiling approach to formulating the defense budget offers little hope for providing truly effective defense budgets adequate to cope with the pace of modern technology."

May 30—"It is time that we recognize the contribution that military space surveillance systems can make to the preservation of peace in the missile era and push their development at top priority with a streamlined military-industrial management team that can achieve significant results within a time span to be truly effective."

June 20—"It [the size of the B-52 airborne alert program] is a decision that can mean the difference between winning a war if it comes or suffering the scorching disaster of defeat."

June 27—"Is the defense budget adequate either in fiscal resources or in the direction in which these resources are being oriented?"

Mr. Hotz has also pled for the B-58, the B-70, the nuclear aircraft program, anti-submarine warfare, jet speed logistics, basic research, Atlas and Titan. He championed the Thor (Douglas developed) over the Jupiter (Army developed). He has not, in my memory, ever recommended the cancellation of any industry-held government contract. He has never criticized the industry or any of its programs.

He often asks for increased defense spending, but he never advocates increased federal taxes.

These are not the views of a well rounded observer. They are closer to the compelling arguments of a congressional lobbyist.

HENRY B. ROSE
Glastonbury, Conn.

(Aviation Week's Editor pleads guilty to advocating the programs listed by Reader Rose but as a matter of accuracy points out that he has never championed the Thor over the Jupiter, has frequently criticized both the transport and manufacturing segments of the aerospace industry and feels that this country can afford what it needs.

Among other "congressional lobbyists" who agree with this latter viewpoint are Republicans Nelson Rockefeller, Robert Lovett, Robert Sprague, Thomas Watson, Jr., and William Foster and Democrats Lyndon Johnson, Stuart Symington and Henry Jackson.—Ed.)

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The system introduces new Bell BRIG gyros. Its accelerometers and digital velocity meters are already operational in missile and space guidance systems.

Hipernas — and many other systems such as the Air Force GSN-5 and the Navy's SPN-10 All-Weather Automatic Landing Systems — typify Bell's capabilities in the broad field of electronics. This diversity of activities offers an interesting personal future to qualified engineers and scientists.

Avionics Division

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